DOCUMENT RESUME

ED 064 532 AA 001 011

TITLE	APEX (Air Pollution Exercise) Volume 3: Air Pollution Control Officer's Manual.
INSTITUTION	Environmental Protection Agency, Research Triangle Park, N. C. Office of Manpower Development.
PUB DATE	[71]
NOTE	97p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Air Pollution Control; City Problems; *Environmental Education; *Environmental Technicians; Management Games; *Pollution; Professional Training; *Role Playing; Simulated Environment; Urban Environment

ABSTRACT

The Air Pollution Control Officer's (APCO) Manual is part of a set of 21 manuals (AA 001 009-001 029) used in APEX (Air Pollution Exercise) a computerized college and professional level "real world" game simulation of a community with urban and rural problems, industrial activities, and air pollution difficulties, The first two sections, which are the same in each of the student manuals (volumes 1 to 19), contain general information about APEX interaction simulation and a glossary of reference terms. The remaining sections contain the following; APCO's role description; an annotated APCO's worksheet; a sample APCO's worksheet; background information for APCO's role; an annotated printout for cycle one; and a map of the 29 APEX analysis areas. The game simulation procedure and required computer facilities are further described in resumes for AA 001 009 and 001 010. (PR)

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Environmental Protection Agency

APEX

Air Pollution Exercise

Simulation Exercises

VOLUME 3

AIR POLLUTION CONTROL OFFICER'S MANUAL

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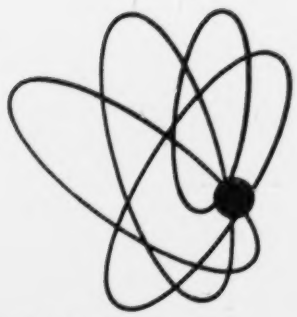
ENVIRONMENTAL PROTECTION AGENCY

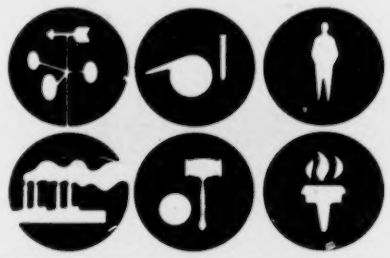


APEX VOLUME 3
AIR POLLUTION CONTROL OFFICER'S MANUAL

This course is designed for professional persons in the field of air pollution control. The course manual has been prepared specifically for the trainees attending the course, and should not be included in the reading lists of periodicals as generally available.

CONDUCTED BY

The Office of Manpower Development's
Institute for Air Pollution Training



ENVIRONMENTAL PROTECTION AGENCY
Office of Air Programs
Office of Manpower Development
Institute for Air Pollution Training
Research Triangle Park
North Carolina 27711

APEX • VOLUME 3 AIR POLLUTION CONTROL OFFICER'S MANUAL

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Volume 1: Game Director's Manual

Volume 2: Computer Operator's Manual

Volume 3: Air Pollution Control Officer's Manual

Volume 4: City Politician's Manual

Volume 5: County Politician's Manual

Volume 6: Industrialist's Manual: No. 1, Shear Power Company

Volume 7: Industrialist's Manual: No. 2, People's Pulp Plant

Volume 8: Industrialist's Manual: No. 3, Rusty's Iron Foundry

Volume 9: Industrialist's Manual: No. 5, Caesar's Rendering Plant

Volume 10: Industrialist's Manual: No. 6, Dusty Rhodes Cement Co.

Volume 11: Developer's Manual: No. 1

Volume 12: Developer's Manual: No. 2

Volume 13: Developer's Manual: No. 3

Volume 14: Developer's Manual: No. 4

Volume 15: Developer's Manual: No. 5

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Volume 17: Developer's Manual: No. 7

Volume 18: City Planner's Manual

Volume 19: County Planner's Manual

Volume 20: Reference Materials

Volume 21: Legal References: Air Pollution Control Legislation

APEX

Air Pollution Exercise

Simulation Exercises conducted by the Institute for Air Pollution Training

The responsibility of the Federal Government's Office of Air Programs to provide leadership and assistance to State and local air pollution control agencies in the recruitment and development of qualified personnel is a major theme of the 1970 Clean Air Act. The Office of Air Programs, (OAP) in conjunction with the University of Southern California and the University of Michigan, has created and developed a simulation exercise identified as APEX (Air Pollution Exercise). This exercise establishes a dynamic atmosphere in which the trainees participate in a "real world" simulation involving a community with urban and rural problems, industrial activities, and a variety of air pollution control problems.

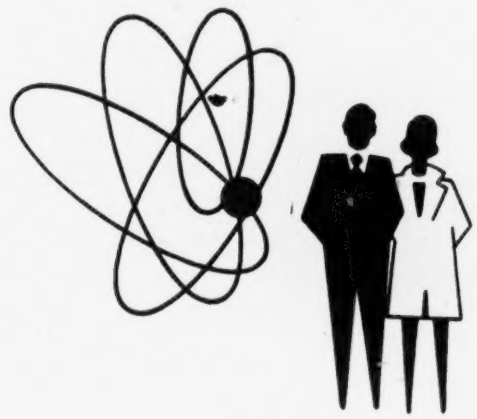
Current and projected uses of APEX have been developed through several of the University Consortia established in conjunction with OAP's Office of Manpower Development.

The use of simulation exercises for the training of air pollution control professionals offers two immediate and vital benefits:

1. A means is provided for a working application of theoretical knowledge; the learner applied information and skills to "real life"

situations. In addition, motivation directed toward additional learning results from participation in seeking solutions to the problems.

2. The focus is provided for solving problems through an interdisciplinary approach, where the interrelationship between "formal" areas of study and application becomes evident.



Students participating in APEX assume the roles of a number of decision makers: city and county politicians, city and county planners, developers, industrialists, air pollution control officers, and concerned citizens. Realistic data are supplied for each role, and the students are required to make decisions that are then analyzed by the computer. Next, the results of the decisions are presented as new situational data representing a year of "actual time." Students participating in these programs — which place special emphasis on air pollution problems —— employ a wide range of skills and knowledge in a variety of areas. Additional opportunities for growth are provided through seminars, lectures, texts, and working contact with recognized authorities in a number of professions.

Within the overall format of the simulation exercise, emphasis is placed upon specific areas through the use of special situations, for example, hearings on air pollution standards or legal actions brought against a particular industry.

Additionally, preparations are underway to introduce APEX as a graduate course at OAP's new Technical Center in the fall of 1971 for students from the Triangle Universities Consortium. In addition to its use at the University of Southern California, APEX is now being conducted as a graduate course at the University of Illinois at Urbana and at Harvard University as part of an Environmental Education program for both graduate and undergraduate studies.

Section 1-1

Introduction to - APEX

APEX is one of, if not the most complex gaming-simulations of an urban area in use today. Although it was designed to supplement standard teaching methods, APEX is far more than an educational tool. It is a communication channel of a new kind -- capable of providing both the language and the forum for information transfer between persons and groups with different educational and cultural backgrounds as well as different prespectives on urban life.

APEX is composed of two essential components (1) a computerized system made up of a series of well-integrated simulation models (2) linked to a "gamed" environment encompassing a series of interactive roles. The computerized system predicts the changes that occur in several sectors of urban life in response to the decisions made by participants in the "gamed" environment, decisions made by persons outside the "gamed" environment (other actors whose behavior is simulated in the computer), and external pressures on the city (also simulated in the computer).

The county of APEX is run year by year by a set of elite decision makers performing both the mundane and extraordinary functions of their office in the "gamed" environment. Each cycle or year is condensed in time to a three to eight hour session during which the decision makers formulate their yearly policy. The decisions that emerge out of the "competitive-cooperative" environment of the gaming-simulation are used as priming inputs to the computer simulation. The change in the status of the urban area is calculated by the computer and returned to the decision makers as the primary input to the next cycle of action. Included in the change picture generated by the computer are selected social indicators measuring the magnitudes of change in assorted key areas and a newspaper serving as the focal point of local public opinion.

The key decision makers acting in the gamed environment include politicians and planners from a central city and a county, an air pollution control officer from the county, and land developers and industrialists from the private sector. The politicians are responsible for the administration of their respective jurisdictions and for the formulation and implementation of various programs to upgrade the social status of their constituents. The planners serve as aides to the politicians and represent the major long range coordinating force in the community. The air pollution control officer is charged with the task of cleaning and monitoring the air mass above APEX county. The land developers and industrialists have the responsibility of running their particular business concerns within the confines of the county. It is expected that each decision maker will find it to his advantage to coordinate and/or compete with other players in his efforts to promote his strategies. The APEX General Interaction Diagram included here (see page) indicates possible linkages among players and between players and the simulation.

In general, people have great difficulty understanding the dynamics of a complex system through traditional means. Gaming-simulation offers participants the opportunity to study, work with, and discuss the struc-

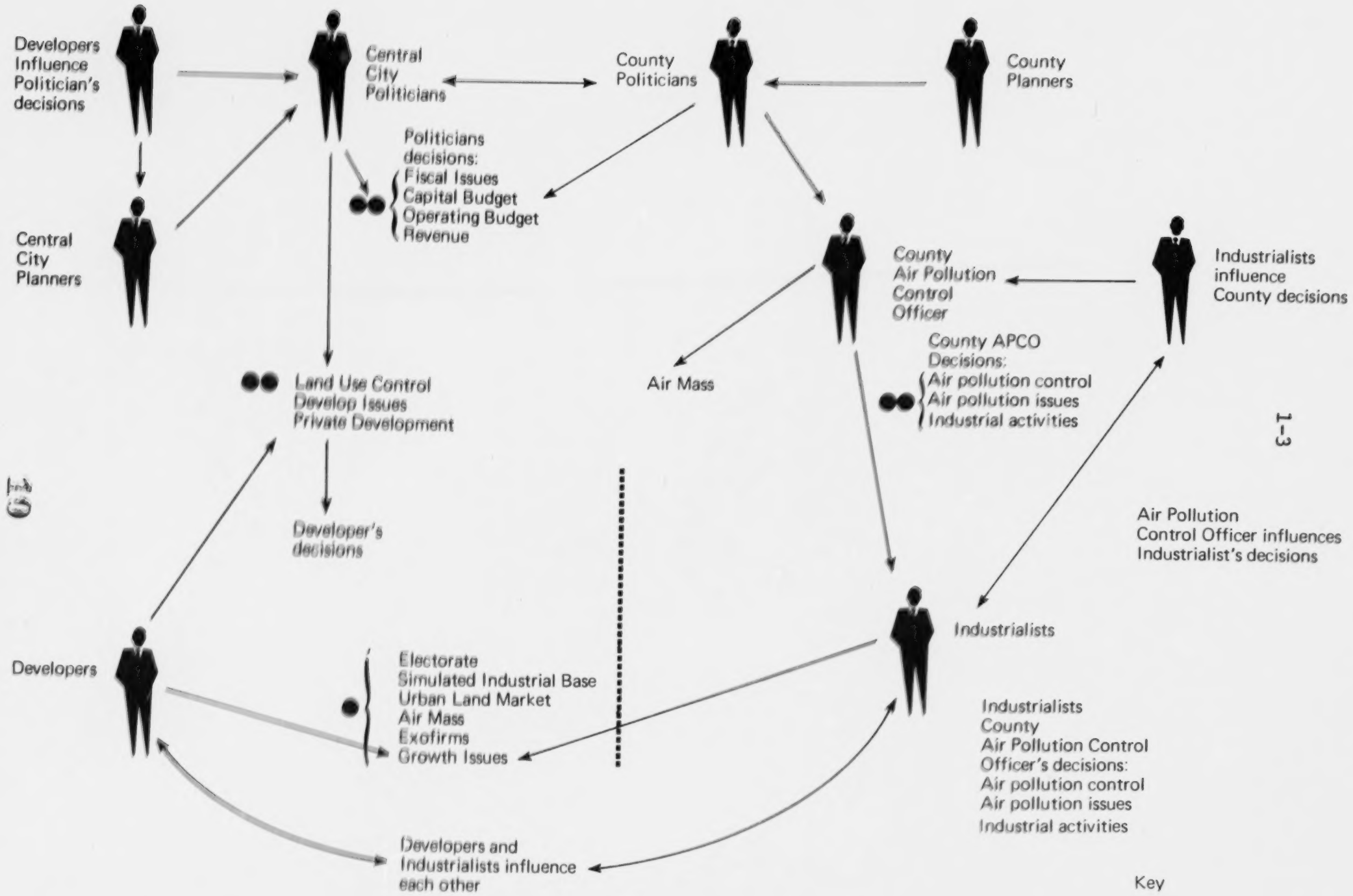
ture of such a system and to experiment with intervention strategies designed to change that structure. When used as a teaching device, the strength of a gaming-simulation such as APEX lies in the opportunity afforded participants for involvemnt in the system. When compared with the passive observation of the system offered by traditional methods, this approach has had great success.

In theory, complex gaming-simulation of the APEX variety is more than a training device or communications facilitator. If the models were more sophisticated the data base more accurate and more complete, a complex gaming-simulation would be a policy testing device for use by practicing urban politicians, planners, APCO's and administrators. Conditional predictions (predictions based on the particular policies and/or decisions submitted to the model) of the ramifications of various decisions can be generated through the use of a complex gaming-simulation -- predictions that may forewarn the model user of unforeseen reactions to policy at several levels of the urban hierarchy ranging from that of the highest level.

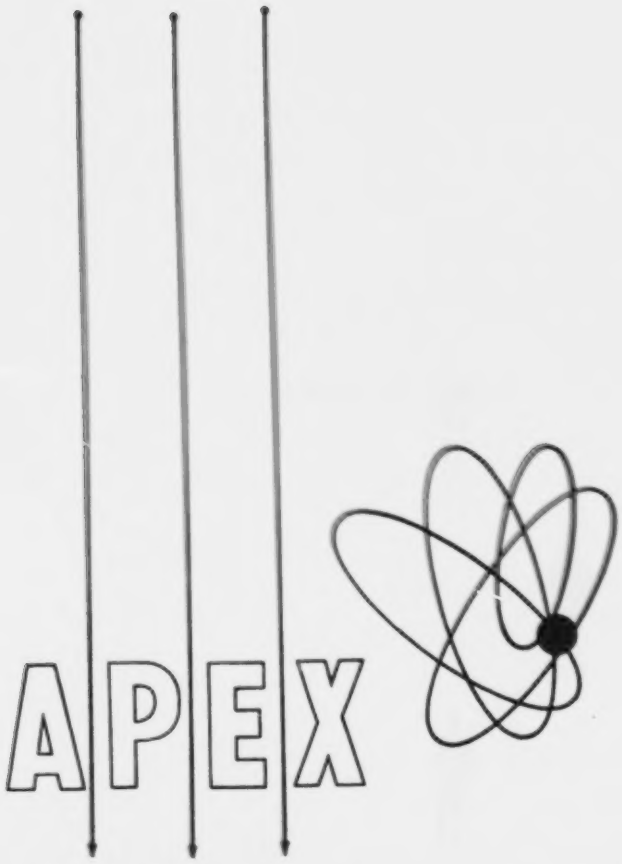
The gamed environment is similar to that found in a typical midwestern industrialized town. (In fact, the prototype city is Lansing, Michigan). It has a population approaching 220,000 including several of minority groups sharing racial or ethnic ties. There is a relatively dense central city in the heart of the county, an adjacent suburb and two outlying townships. Most of the industry is located in the central city (as are the minority groups). Major firms include a large auto plant and the state government offices. The suburb houses a major university. The townships are largely agricultural, although urbanizing settlements are dotting the landscapes. There is a major river running through the city serving as the primary drainage system for the county. The climate of APEX is temperate, with summer temperatures averaging about 70 degrees and winter temperatures averaging near 25 degrees. Prevailing winds are westerly, swinging to the southwest in summer and northwest in winter.

For the purposes of the gaming exercise, APEX county is divided into 29 analysis areas (see the attached map, Section 9). Population, employment and land use will be allocated to the areas and are categorized by types established especially for APEX. These types are described in the glossary included in this manual (Section 2) a glossary designed to aid participants in learning the terminology of urban and environmental management as well as that of the gaming exercise.

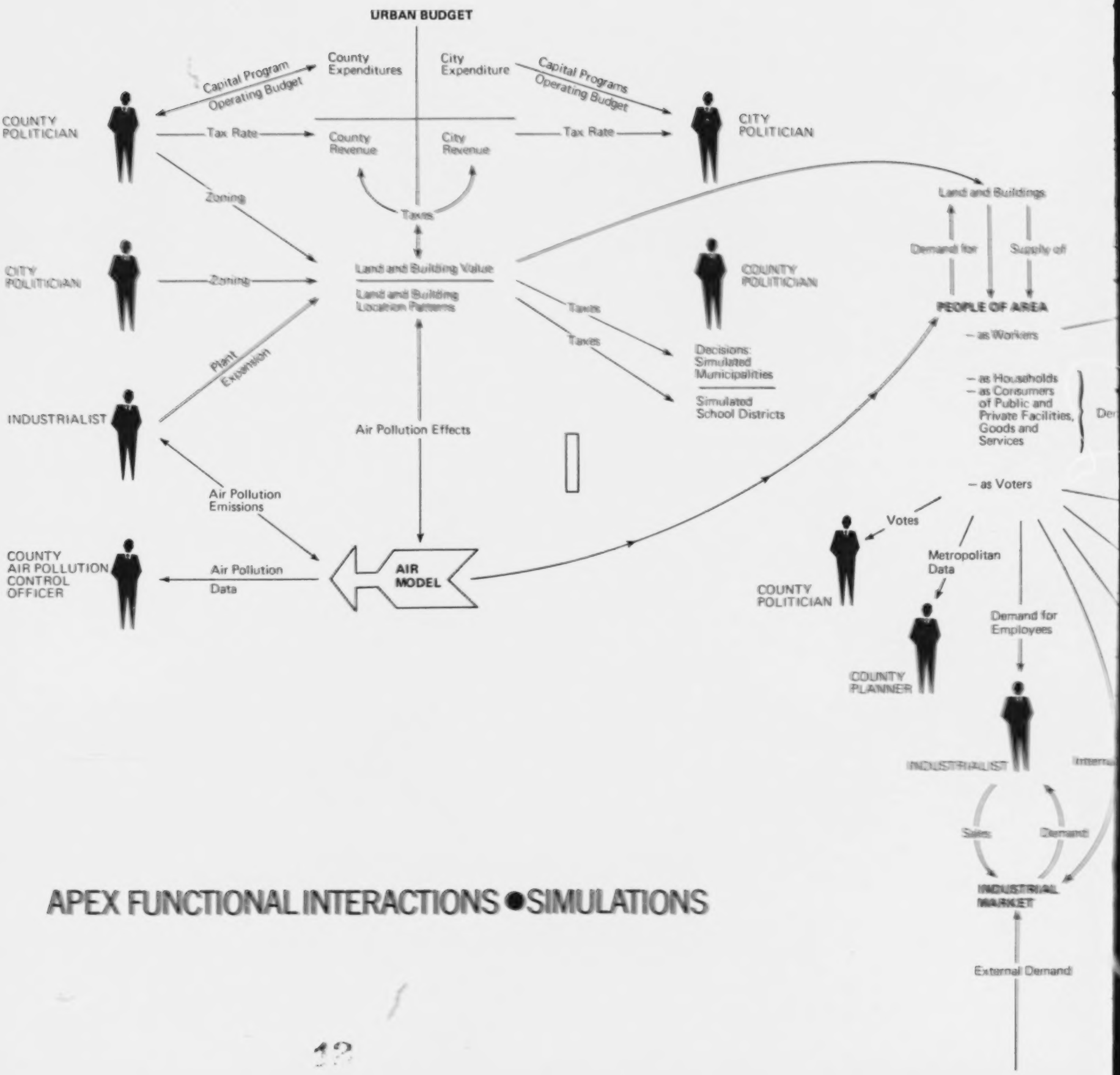
FOR ADDITIONAL INFORMATION:
Address inquiries to Chief, Institute for Air Pollution Training
Environmental Protection Agency
Research Triangle Park, North Carolina 27711



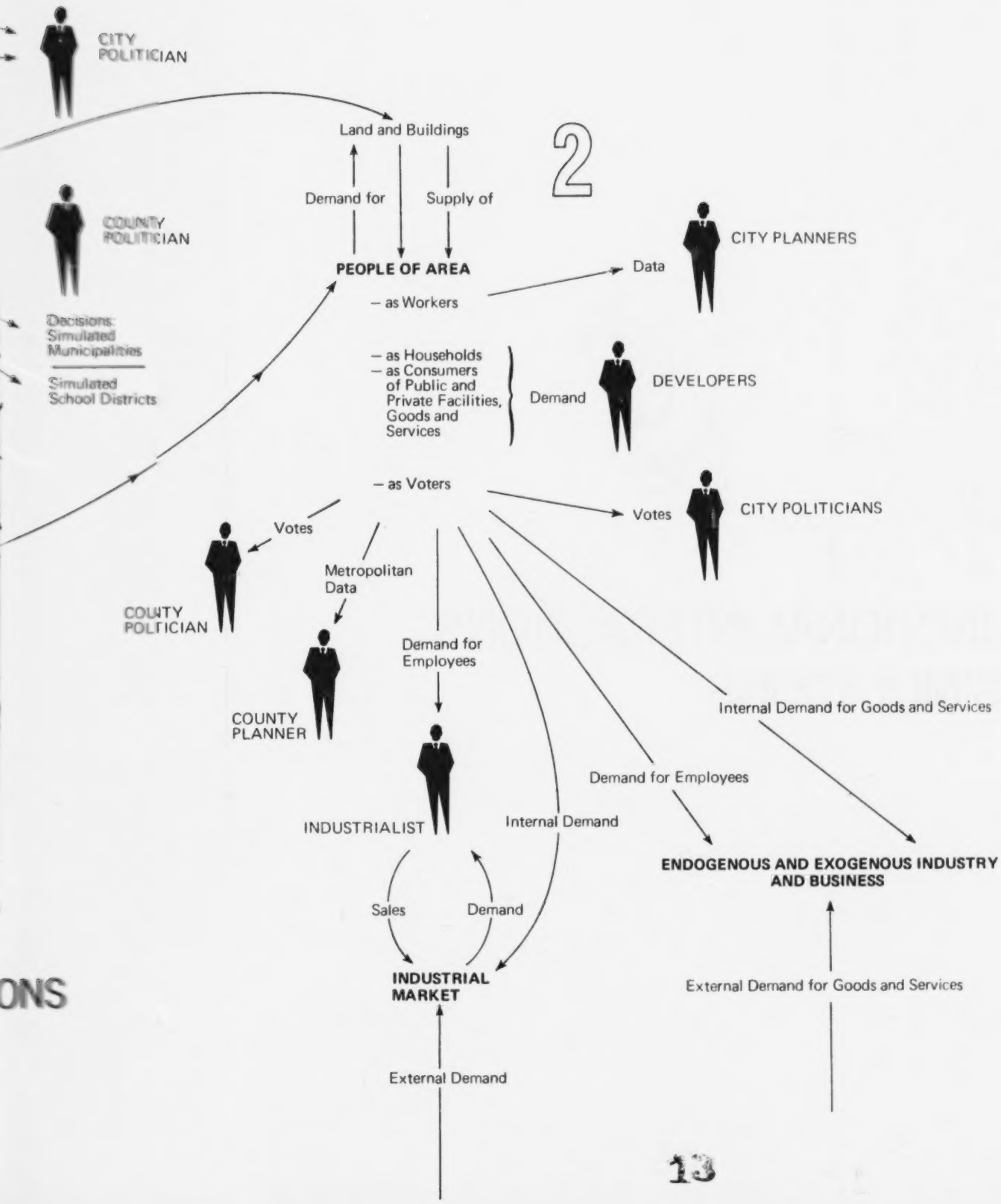
APEX GENERAL INTERACTION DIAGRAM

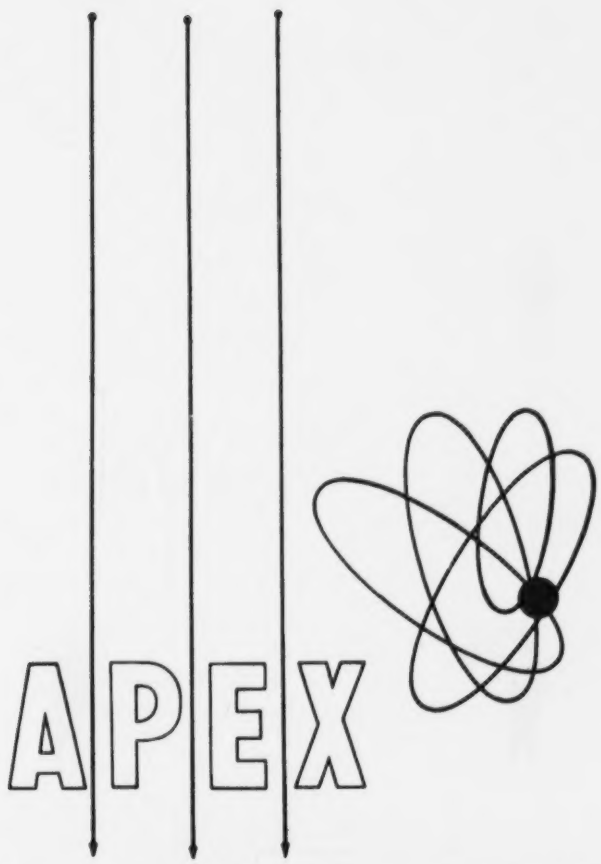


FUNCTIONAL INTERACTIONS
● SIMULATIONS

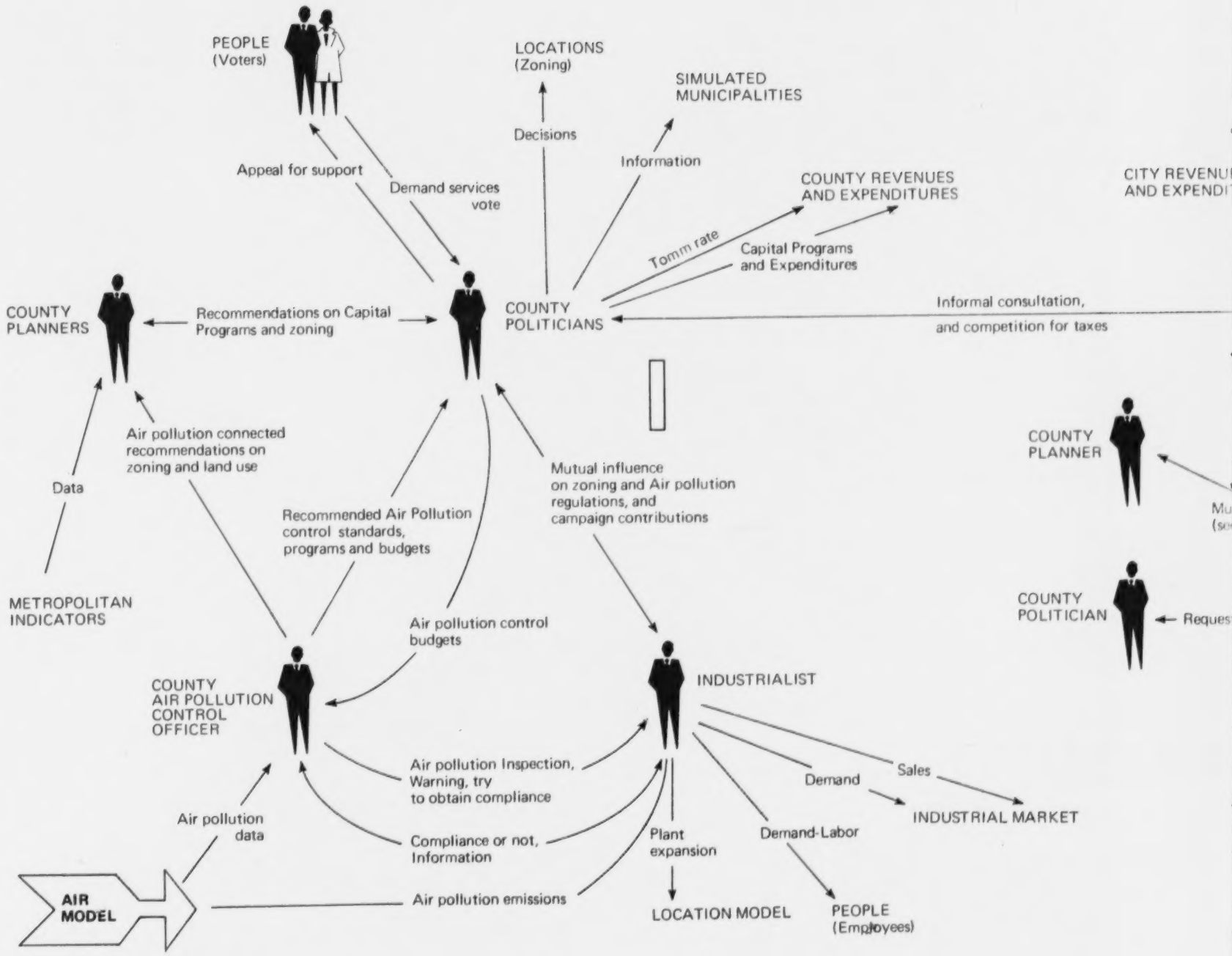


APEX FUNCTIONAL INTERACTIONS ● SIMULATIONS

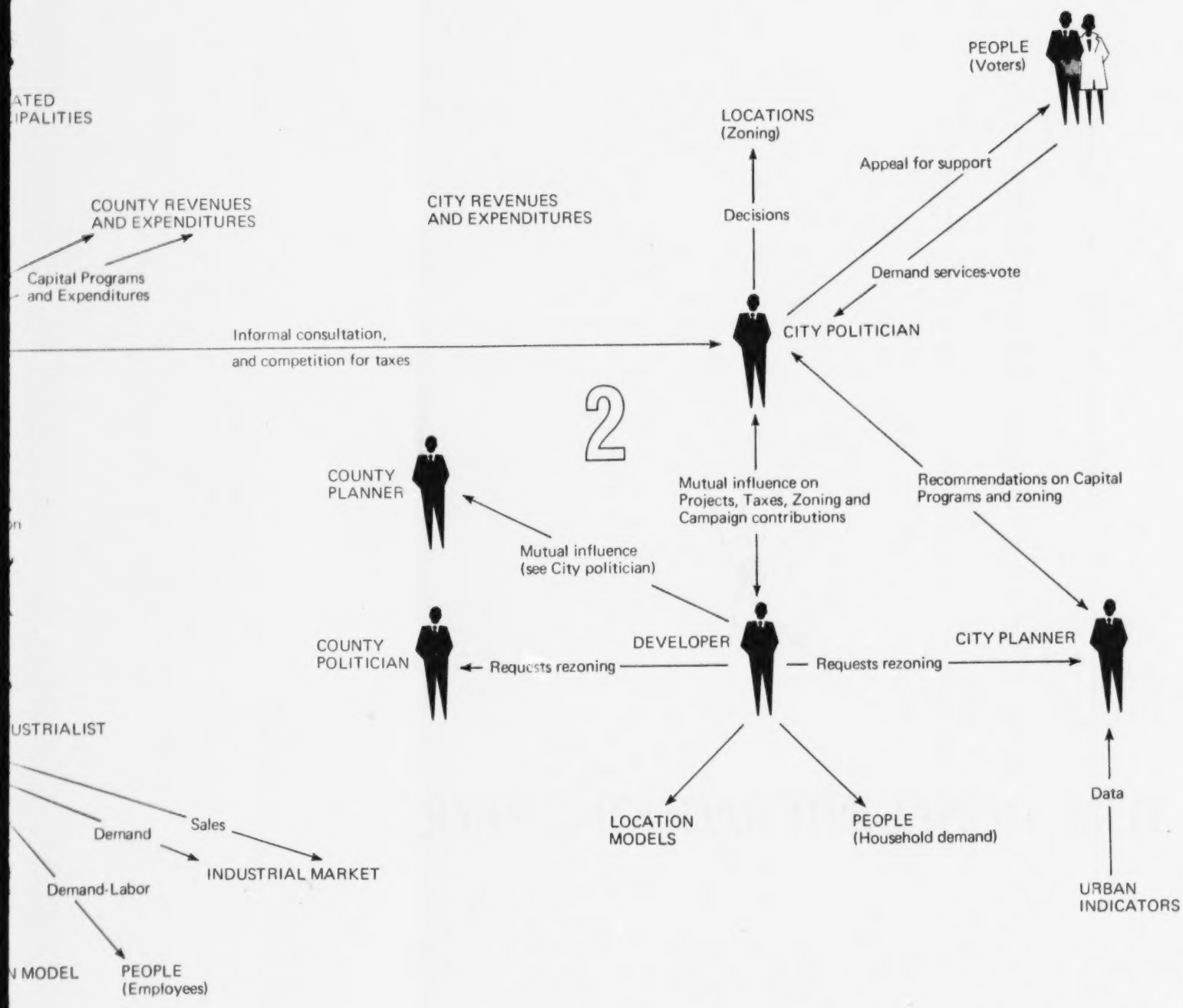

CITY POLITICIAN
COUNTY POLITICIAN
Decisions: Simulated Municipalities
Simulated School Districts
Land and Buildings
Demand for
Supply of
2
PEOPLE OF AREA
– as Workers
Data
CITY PLANNERS
– as Households
– as Consumers of Public and Private Facilities, Goods and Services
Demand
DEVELOPERS
– as Voters
Votes
CITY POLITICIANS
Votes
COUNTY POLITICIAN
Metropolitan Data
COUNTY PLANNER
Demand for Employees
Internal Demand for Goods and Services
Demand for Employees
INDUSTRIALIST
Internal Demand
ENDOGENOUS AND EXOGENOUS INDUSTRY AND BUSINESS
Sales
Demand
INDUSTRIAL MARKET
External Demand for Goods and Services
External Demand



FUNCTIONAL INTERACTIONS ● ROLES



APEX FUNCTION



APEX FUNCTIONAL INTERACTIONS ● ROLES

Section 2-1

GLOSSARY AND REFERENCE TERMS

ABATEMENT

Abatement is the reduction of pollutant emissions from a source or sources.

AIR POLLUTION

Air pollution is the presence in the outdoor air of substances which, when present in sufficient quantity or over a period of time, can cause an undesirable effect upon man, property, or the environment.

AIR POLLUTION REGULATIONS

Air pollution regulations are legal constraints on pollutant emissions, production processes, or control systems. State regulations and County regulations are enforceable by legal sanctions, while recommendations are not.

AIR QUALITY

Air quality refers to the pollution concentration characteristics of the atmosphere or ambient air in a given area. It is usually stated in terms of the levels of concentration of specific pollutants, in parts of pollutant per million parts of air. (See CONCENTRATION.)

Air Quality Goals are expressions of desirable maximum pollutant concentrations to be achieved through a pollution control program.

Air Quality Standards are quantitatively-specified maximum levels of pollutant concentrations or dosages, as more precise statements of air quality goals.

ALERT STAGES

Alert Stages refer to critical levels of concentration or dosage signalling potential disastrous pollution effects and requiring emergency abatement and control measures.

ANALYSIS AREA (A.A.)

Analysis areas are used as the primary areal reference units for the data and issues throughout the game. The County is divided into a number of analysis areas, each of which is the approximate size of several census tracts. The analysis areas included in the five jurisdictions are as follows:

Jurisdiction 1 -- Central City: Ward 1 = AA 1 through AA 4
Ward 2 = AA 5 through AA 8
Ward 3 = AA 9 through AA 13

Jurisdiction 2 -- Suburb: AA 17 through AA 19

Jurisdiction 3 -- Township 1: AA 23 through AA 28

Jurisdiction 4 -- Township 2: AA's 14-16, 20-22, 29

Jurisdiction 5 -- County: AA's 1-29

(See APEX Analysis Area map)

ANNUAL WAGE

This is the annual cost to the Industrialist of one worker and is an average of the various rates of pay applicable to the different types of workers in the firm. The applicable average wage rate for each firm is reported in the Industrialist's output each cycle under cost factors.

ASSESSED VALUE

Assessed value is the value assigned to real estate property for purposes of assessing taxes owed to each of the Jurisdictions, County and school districts. Governments are required by law to maintain an assessed value of 50% of market value for property in their jurisdiction, although this requirement is often not met. (E.g. if a residential property is valued on the market at $20,000, its assessed value is $10,000.) (See STATE EQUALIZED VALUE.)

BOARD OF DIRECTORS

Each Industrialist acts as a Plant Manager and is responsible to the Board of Directors of his plant for his decisions and actions. The Board has the ultimate decision-making power in Plant affairs and may approve, amend or reject the Manager's fiscal policy proposal. The Board also sets the amount of dividends to be paid to the stockholders.

BONDING

Bonding is the process of incurring public debt to finance some capital improvement project. It is a device used to extend the incidence of costs over a long period of time, rather than have costs met out of current revenues while the project is under construction. Politicians may issue two kinds of bonds, general obligation bonds and revenue bonds. These differ in three respects: (1) the need for voter concurrence, (2) how they are paid off, and (3) the kinds of projects for which they are appropriate. Before Politicians may float general obligation bonds to finance projects, voters must approve this action in a referendum. There is a State-imposed limit on the indebtedness that a jurisdiction may incur through general obligation bonds. The amount of additional

bonded indebtedness that can be sought is indicated in the Politician's output as "$ Limit on Next Bond Sought".
(See DEBT RETIREMENT for the process of financing general obligation bonds.)
Revenue bonds are not submitted to a referendum and are appropriate only for particular projects. (Projects for which they may be used are noted in the Project List.) They are paid off through fees collected for the service provided by the facility, rather than by taxes.

CAPITAL PLANT INDEX (C.P.I.)

The capital plant index is a ratio of the present dollar value of public capital facilities (sewers, water lines, streets, parks and miscellaneous public holdings) to population equivalents. This number reflects the load imposed on facilities by residents, employees and clients, and thus is considered as an indication of the relative level of adequacy of these facilities. Present dollar value is calculated each cycle on the basis of depreciated value of existing facilities plus new facilities. (Facilities depreciate at about 5% of original value per year.)
(See POPULATION EQUIVALENT.)

CASH CARRYOVER

This is the cash reserve which an Industrialist or Developer carries over to the next cycle after making all his expenditures, including those for capital plant. It represents as-yet uncommited funds, which the player is free to use in the next cycle.

CASH TRANSFER

A cash transfer is used for loans or gifts of cash between players when the reason for the exchange is unspecified. Revenues made, or expenditures incurred, through an exchange of cash between either the Government, Industrialist, or Developer, are recorded in the budget section of the output. When applicable, cash transfers are also used to cover the cost of television time and newspaper articles.

COMBUSTION

Combustion is the process of burning fuel or wastes.

CONCENTRATION

Concentration is the ratio of pollutants to effluent gases or ambient air, measured in parts per million (ppm) as a volume to volume ratio, or micrograms per cubic meter (UG/cubic meter) as a weight to volume ratio. Data on mean concentration per quarter, concentration on worst day, and number of days above a specified concentration can be obtained by the APCO, through the installation and operation of monitoring stations.

CONTAMINANT See POLLUTANT

CONTROL EFFICIENCY

Control efficiency refers to the ratio of the amount of a pollutant removed from effluent gases by a control device to the total amount of pollutant without control.

CONTROL SYSTEM

Control system refers to equipment and/or procedures intended to reduce the amount of a pollutant, or pollutants, in effluent gases. Each gamed industrial firm has a limited set of control system options for each production or combustion process.

DEBT RETIREMENT (Debt Service)

Debt retirement, or debt service, is a term used to describe the process of paying off long-term general obligation bonds sold by public agencies. Debt retirement is a budget category of the Politician which includes expenditures for both principal and interest on general obligation bonds. Financing of these expenditures may be with either normal millage or debt retirement millage.

DEMOLITION COSTS (Clearance Costs)

A demolition cost of 5% of the assessed value of developed property must be paid when developed land is rezoned.

DENSITY

In residential areas, density is the term used to express the number of dwelling units per acre of land. In APEX a different density is associated with each of the five residential development types, with the lowest density found in land use category R-1 and the highest in category M-2.
The table on the following page expresses housing density in housing units per acre, and in acres per housing unit.

DEPRECIATION ALLOWANCE

Each cycle, the total value of capital facilities, (building and equipment) depreciate. A tax credit of 5% of the capital value facilities is allowed the industrialist to compensate for this depreciation. The amount is deducted before Federal and State income taxes are paid. The industrialist may claim any part of his maximum allowance; any portion of the allowance not taken will accumulate. The maximum depreciation allowance is listed under cost factors in the industrialist's output.

HOUSING DENSITY

AA	R-1		R-2		R-3		M-1		M-2	
	Units per Acre	Acres per Unit	Units per Acre	Acres per Unit	Units per Acre	Acres per Unit	Units per Acre	Acres per Unit	Units per Acre	Acres per Unit
1	1.4	.71	3.5	.29	5.6	.178	11.2	.089	21.0	.047
2	2.4	.41	6.0	.16	9.6	.104	19.2	.052	36.0	.027
3	2.0	.5	5.0	.20	8.0	.125	16.0	.062	30.0	.033
4	2.8	.35	7.0	.14	11.2	.089	22.4	.046	42.0	.023
5	2.1	.47	5.3	.18	8.4	.119	16.8	.059	31.5	.031
6	1.6	.62	4.0	.25	6.4	.156	12.8	.078	24.0	.041
7	2.5	.4	6.3	.15	10.0	.10	20.0	.050	37.5	.026
8	3.0	.33	7.5	.13	12.0	.083	24.0	.041	45.0	.022
9	1.2	.83	3.0	.33	4.8	.208	9.6	.104	18.0	.055
10	2.5	.4	6.3	.158	10.0	.10	20.0	.050	37.5	.026
11	1.0	1.	2.5	.4	4.0	.25	8.0	.125	15.0	.066
12	1.0	1.	2.5	.4	4.0	.25	8.0	.125	15.0	.066
13	1.0	1.	2.5	.4	4.0	.25	8.0	.125	15.0	.066
14	.5	2.	1.3	.76	2.0	.5	4.0	.25	7.5	.013
15	.6	1.66	1.5	.66	2.4	.41	4.3	.208	9.0	.011
16	.8	1.25	2.0	.5	3.2	.31	6.4	.156	12.0	.083
17	1.2	.83	3.0	.33	4.8	.208	9.6	.104	18.0	.055
18	2.3	.43	5.8	.172	9.2	.108	18.4	.054	34.5	.028
19	3.0	.33	7.5	.13	12.0	.083	24.0	.041	45.0	.022
20	.8	1.25	2.0	.5	3.2	.31	6.4	.156	12.0	.083
21	.5	2.	1.3	.76	2.0	.5	4.0	.25	7.5	.013
22	.4	2.5	1.0	1.	1.6	.62	3.2	.31	6.0	.16
23	.7	1.42	1.8	.55	2.8	.35	5.6	.178	10.5	.095
24	.3	3.33	.8	1.25	1.2	.83	2.4	.41	4.5	.022
25	.4	2.5	1.0	1.0	1.6	.62	3.2	.31	6.0	.16
26	.3	3.33	.8	1.25	1.2	.83	2.4	.41	4.5	.022
27	.6	1.66	1.5	.66	2.4	.41	4.8	.208	9.0	.011
28	.3	3.33	.8	1.25	1.2	.83	2.4	.41	4.5	.022
29	.5	2.	1.3	.76	2.0	.5	4.0	.25	7.5	.013

DEVELOPMENT TYPES AND COSTS

A. Residential

In APEX there are various levels of cost and density associated with different qualities and sizes of housing which may be built by Developers. These costs are for structures, exclusive of land and site improvements.

Single Family

Three different development-cost levels are applicable to APEX single-family housing units, ranging from the highest construction cost of $40,000 (designated as R-1) to the lowest cost housing, built at $15,000 per unit (designated as R-3). Any one of these types may be built on land which, when vacant, is zoned R.

Multiple Family

Units of two different cost levels, M-1 and M-2, are available for construction of multi-family housing in APEX. The highest cost per unit, for M-1, is $30,000 and the lowest, for M-2, is $12,000. Either of these types may be constructed on vacant land zoned M.

Residential Development Costs per Unit

R-1	R-2	R-3	M-1	M-2
$40,000	$22,500	$15,000	$30,000	$12,000

B. Commercial

Two types of commercial land use are allowable in APEX. These relate to local neighborhood shopping facilities and to regionally-oriented commercial and service facilities. Both may be built only on zoning category C land. Each is developed on a cost-per-acre basis, as follows:

Commercial Development Costs by Type

CL	CR
$100,000	$125,000

C. Industrial

Endogenous industrial development permitted Developers in APEX is on a per-acre basis, the cost being $100,000 per acre. Zoning category I land may be developed into this land use.

(See ZONING CATEGORY.)

DOSAGE

The specified time duration of an air pollutant's critical concentration level in a particular location, or for a particular person, material, etc., is known as dosage.

EFFLUENT

Effluents are the total gaseous emissions from production and combustion processes and activities, including air pollutants and non-noxious material.

ELITE OPINION POLL (E.O.P.)

The Elite Opinion Poll calls for a vote of all game players on certain major policy issues in the community. These issues appear as headlines in the W.E.T.R.O.-[illegible] News, which ask for either a deciding or advisory vote. The results of the Poll affect public officials' chances of re-election, as well as the probabilities of passage of general referenda and specific bond issue and special millage requests.

EMISSIONS

Emissions are pollutants in effluent or exhaust gases which are released into the air.

EMISSION FACTORS

Emission factors are estimates which can be used to approximate the rate of emissions of specific pollutants from generalized sources.

EMISSION MEASUREMENT

Air pollution emissions are measured in pounds per hour for particulates, sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen oxides (NO_x), and hydrocarbons (HC); in Ringelmann number for smoke; and in Stinkelmann number for odor. The emissions measured are of specific pollutants from specific sources.

EMISSION RATE

Emission rate refers to the amount of pollutant emitted per unit of time. Maximum allowable emissions will be specified in pounds per hour if they refer to emission rates.

EMISSIONS SOURCE

An emission source is the origin of some specific air pollutants. In the game there are several point sources, about thirty non-point point sources, plus motor vehicles and space heating as line and area sources, respectively.

EXOFIRM (EXOGENOUS FIRM)

An Exofirm is an industry or bureaucratic firm that depends primarily upon markets outside the local area for its growth and vitality. These firms are usually classified as Exofirms on the basis of their being net importers of dollars and net exporters of products or services to these outside markets. Jobs created by Exofirm growth spur additional growth of households and jobs oriented to the local market. (Exofirms are also often referred to as basic firms).
In APEX, Exofirms locate in zoning categories I and O.
Periodically, the newspaper will note the opportunity for Developers to invest, in a speculative way, in the entry of new Exofirms into the metropolitan area, with a variable probability of success attached to such investments. Occasionally, these Exofirms require rezoning of land and/or installation of special capital improvements. Requirements for such special public action and requests for private investment will be noted in the newspaper announcement of the firm's interest in locating in the area.

FUEL RATE

The amount of fuel consumed by each industry per unit of time is specified in tons/hours for coal, in barrels (bbl)/hour for oil, in thousand cubic feet (MCF)/hour for natural gas, and in megawatts (MW) for electricity.

FUEL TYPE

The fuel type possibilities include: low-grade coal (Lo-Coal), high-grade coal (Hi-Coal), low-grade oil (Lo-Oil), high-grade oil (Hi-Oil), natural gas, and electricity. The fuel option for each plant is listed in the Industrialist's output. The fuel grade refers inversely to the air pollution potential of the burning fuel, i.e., Lo-Grade has high pollution potential, and Hi-Grade fuels have low pollution potential.

HOUSEHOLD TYPES

The five household types used in APEX are characterizations of families belonging to fairly homogeneous socio-economic groups. These characterizations reflect life style, political involvement and voting habits, general consumption behavior and preference for public goods. There is substantial overlap of income levels for all status groupings; hence income, alone, is a weak indicator for characterizing households.

Household Type I — is upper class and upper-middle class combined. Occupations of the heads of households are: professionals, technical workers, managers, officials, and proprietors. One-half of the family income levels are in excess of $35,000 and the other half are in the $20,000-$35,000 range. Value of housing is in excess of $20,000, and if they rent, rentals are over $300 per month. This is the group which is most concentrated in residential location. Education of the head of the household is at least college graduate, often with post-graduate study. Pressure group membership for this household type is found in the Chamber of Commerce and Good Government League.

Household Type II -- is the typical middle-class household in which the head's occupation is clerical, sales, or kindred types. Income of the family is primarily in the $7,000-$10,000 range. Education of the head of the household is some college or at least high school graduation. Housing value is primarily in the $15,000-$25,000 range, and gross rentals would usually be from $100 to $149 per month, though they may be somewhat lower. Pressure group affiliations for this type are with the Good Government League on the one hand, and with the ultra-conservatives on the other.

Household Type III -- the most numerous and widely-distributed of the five types is characterized by a mixed membership of very low income white collar workers, skilled craftsmen, and foremen, though the latter two predominate. In the outlying areas, farmers fall into this category. Family income is primarily in the $5,000-$9,000 range. The head of household's education is typically high school graduation. Housing value is usually in the $12,000-$20,000 range and rentals are from $80-$125 per month. Members of this group are apt to belong to the unions and/or the ultra-conservative pressure group.

Household Type IV -- is composed of semi-skilled workers, industry operatives and non-household service workers, such as waiters, barbers and parking-lot attendants. Family income is in the lower portion of the $4,000-$7,000 range. Housing values range from $10,000 to $14,000 with gross rentals being $70 to $90 per month. Education of the head of the household is usually 9 to 11 years. Pressure group membership for this household type is found in the unions and among the civil rights groups.

Household Type V -- is the lowest stratum of society, and heads of households are laborers or household service workers. The vast majority of the area's unemployed are of this type and roughly half of all members are elderly and retired. Family income is less than $5,000 annually and the value of housing is less than $10,000, with rentals primarily $50-$75 per month. Heads of households have usually not been educated beyond the eighth grade. Membership in pressure groups is found in the unions and civil rights groups.

Political involvement of the five household types declines from type I (the highest) to type V, the latter being generally apathetic. Likewise, concern with government operation and provision of public services is highest in type I households and declines steadily through type V families.
The five household types will tend to demand housing of the five residential development types according to the following percentages:

Household type I -- 50% will choose R-1; 30%, R-2, and 20%, M-1.
Household type II -- 20% will choose housing in each of the five development types.
Household type III -- 10% prefer R-1; 30% prefer R-2; 20% choose R-3; 25% take M-1, and 15%, M-2.
Household type IV -- 20% will choose R-2; 40%, R-3; 10%, M-1, and 30%, M-2.
Household type V -- 40% will be in R-3; 60% in M-2.

IMPROVEMENT COSTS

Improvement costs are fees to prepare raw land for development, including subdivision costs, sewer and water connections, drainage and engineering. Developers are required to pay improvement costs on all land on which they build structures. For residential property, improvement costs are on a per unit basis as follows:

R-1	R-2	R-3	M-1	M-2
$1,000	$800	$700	$600	$400

For commercial and local industrial land uses, improvement costs are on a per acre basis; for each the fee is $5,000 per acre.

These fees are automatically applied to all land on which the Developer builds.

INTEREST RATE

The cost of borrowing money will vary for the Industrialists and Developers according to both their credit rating and the length of the loan, i.e., how many years will be taken to repay it. Applicable interest rates are as follows:

	Credit Rating		
Years to Repay	A-1	A-2	A-3
1-2	4%	6%	8%
3-5	6%	8%	12%
6-10	8%	12%	16%
11-20	12%	16%	20%

The cost of borrowing money for governmental agencies -- the interest rate on bonds -- will vary according to the credit rating of the jurisdiction, and will differ between general obligation and revenue bonds. Since revenue bonds are not backed by governmental taxing power they are riskier and therefore carry higher interest rates than general obligation bonds. As a jurisdiction's credit rating falls from A-1 to A-3, the interest rate on general obligation bonds will increase from 4.5% to 6%.

ISSUE

Issue is used to refer to a problem situation presented to players in the APEX News. Following each issue are two to four alternatives from which one must be selected. (See ELITE OPINION POLL.)

JURISDICTION

Jurisdiction refers to one of the political units in APEX. Abbreviations used in the game are:

CC - Central City (Jurisdiction 1)
S - Suburb (Jurisdiction 2)
UT 1 - Township 1 (Jurisdiction 3 or Western Township)
UT 2 - Township 2 (Jurisdiction 4 or Eastern Township)
Co - County (Jurisdiction 5)

(See ANALYSIS AREA.)

LAND USE

Land use refers to the types of structures built upon particular pieces of land.

(See DEVELOPMENT TYPE and ZONING CATEGORY.)

MAXIMUM PRODUCTION CAPACITY

This is the maximum number of units which can be produced by a gamed industry in a cycle, given the plant and equipment in existence during that cycle. Maximum capacity may be increased by making capital expenditures for building and equipment. New productive capacity becomes available only in the cycle following that in which money is budgeted for plant expansion.

MILLAGE

Millage is the tax rate, in mills, which is applied to State equalized property value to generate property tax revenue. One mill is equal to a $1 charge on each $1000 of value, or one tenth of one percent of the State equalized value. There are three types of millage:

A. Normal Operating Millage is determined by local Politicians and is applied to standard operating costs of government by State and local law -- the local limit can never be higher than the limit set by the State.

B. Special Millage, which is not subject to State and local limits, can be used for financing special programs. It must be voted on in a referendum.

C. Debt Retirement Millage is not subject to the state and local limits but it can be used for retiring capital project bonds. This millage requires a favorable vote in a referendum.

Total millage is the sum of operating millage, any special millages and the debt retirement millages which may be in effect during the year.

MONITORING STATION

A monitoring station is a piece of equipment placed at a given location for measurement of air quality. An air quality monitoring station of one of five types may be installed and operated in any analysis area. The pollutants measured by each type of monitoring station are:

Type 1: Particulates
Type 2: Particulates and SO_2
Type 3: Particulates, SO_2, and CO
Type 4: Particulates, SO_2, CO, and NO_x
Type 5: Particulates, SO_2, CO, NO_x, and Hydrocarbons

PARTICULATES

Particulates are solid particle air pollutants, which may be suspended in the air or may settle out, depending on the size of the particles, wind speed, and other factors.

PLANT INSPECTION

A plant inspection is an "on-site" examination of production and pollution control equipment, processes and procedures. Plant Inspections ordered by the APCO will provide him with information on the production processes; production capacity; fuel and process rates; control systems; smoke code (Ringelmann number); and odor code (Stinkelmann number) for each process of a specific gamed or non-gamed emission source.

PLANT MANAGER

The player in the role of Industrialist is acting as a Plant Manager. (See BOARD OF DIRECTORS.)

POPULATION EQUIVALENT

The population equivalent is a means of converting (a) residents, and (b) employees and clients of industries and commercial facilties into a standard measure of the demand placed on such public capital facilities as sewers, streets, and water supply. The population equivalent of an area (analysis area or jurisdiction) is computed as follows:

P.E. =[Total households]+[.8 × all employees of commerce and industry]

For use of population equivalents in APEX, see CAPITAL PLANT INDEX.

PRESSURE GROUP

There are five pressure groups represented in APEX which take stands on public policy issues and can influence voter behavior. The more extreme the position assumed by the pressure groups, either pro or con, (as indicated by a scale of +4 to -4), the greater will be the voter turnout for referenda and elections. Each pressure group derives its constituency from members of two or more household types. (See HOUSEHOLD TYPES)

1. Civil Rights Groups -- find their leadership in the elite liberal and in ghetto activists. The majority of their followers come from lower social strata. These groups represent both Negroes and Mexican-Americans. The orientation of the groups is primarily toward what they consider bread-and-butter issues, such as fair employment, and toward actions which focus on the neighborhoods in which they live. Thus, the Civil Rights groups tend to be active in specific cases, but their influence is moderate.

2. Good Government League -- is overwhelmingly middle-class, composed primarily of professional people, a heavy percentage of them women. This group is interested in a wide range of issues, in which they exert moderate influence, and is oriented toward governmental efficiency and toward community growth and image.

3. Chamber of Commerce -- draws many members from the business community and some from professional groups such as law, engineering, and medicine. This group exerts the highest degree of power of all pressure groups and is oriented primarily toward community image and "boosterism". However, when an issue tends to split the business community, this group is likely to take no position.

4. Unions -- are more conservative locally than nationally and exhibit some divergency between craft unions and industrial unions, the former being more conservative. The unions exert moderate influence on a range of issues somewhat less broad than those of interest to the Good Government League. The conservatism of the unions is especially apparent in the opposition of some of its constituency to public spending for social welfare.

5. Ultra-Conservatives -- draw membership from people who are isolated from most community affairs. Although members have average incomes, the education level of most is lower than the community average. These groups become involved in public issues only sporadically, taking extreme and noisy positions when they feel personally affected by proposed public actions.

PROCESS RATE

Process rate refers to the amount of materials processed by an Industrialist per unit time. The measure is specified in tons, pounds, barrels, per minute, hour, etc.

PRODUCTION LEVEL

This is probably the key item determined by an Industrialist each cycle. It is the number of units of a product his plant will produce in that cycle. The Industrialist is free to set his production at any level he chooses, as long as the figure he sets does not exceed his maximum production capacity.

PRODUCTION PROCESS

A production process is a definable part of the overall production system

a given firm. Each gamed industrial firm may have up to eight production processes, while each non-gamed industrial firm is assumed to have only one process.

QUASI-PUBLIC LAND

This is land owned by tax-exempt organizations such as churches and fraternal organizations. Such land includes church buildings and schools, cemeteries and such miscellaneous buildings as Elks lodges.

REFERENDUM

A referendum is a vote of the (simulated) population of a jurisdiction on some issue presented to the people by the Politician. Most usually referenda are called to approve (or reject) a general obligation bond issue or a request for special millage, although they may be called to approve some legislative matter, such as open housing.

REZONING APPLICATION FEE

The rezoning application fee is a charge of $100, which is assessed for each rezoning request submitted by a Developer or Industrialist. It is included in that player's financial statement for the next cycle.

RINGELMANN NUMBER

The Ringelmann Number is a code for measuring the blackness of smoke plumes and is equivalent to the opacity. Ringelmann Numbers and opacities are used for specifying allowable smoke emissions (Ringelmann for black and opacity for other colors). #0 = zero opacity, #1 = 20%, #2 = 40%, #3 = 60%, #4 = 80%, #5 = 100%. In APEX, all smoke readings are reported as Ringelmann Numbers.

STATE EQUALIZED VALUE

State equalization is a process designed to even out differences in assessment practices among political jurisdictions. The state equalization factor applied to each jurisdiction's assessed value will thus be different. The state equalized value for a jurisdiction, reached by applying the factor to local assessed value, is the base on which millage is levied to generate property tax revenues.

STINKELMANN NUMBER

The Stinkelmann Number is a code (developed in APEX) for measuring odor emissions, and for specifying maximum allowable odor emissions. Numbers range from 0-5, covering least to worst odor levels, respectively.

TAX RATE

See MILLAGE.

UNIT COSTS

The costs to the Industrialist of operating his plant are calculated, for each production component, except labor, on the basis of the amount and cost of each component required to produce one unit of the product. These unit costs apply to fuel, administrative overhead, inventory, and raw materials.

Fuel Cost applies to the fuel required to produce each Industrialist's product and will be different for each fuel type.

General Administrative Costs include all overhead expenditures, other than salaries, involved in production.

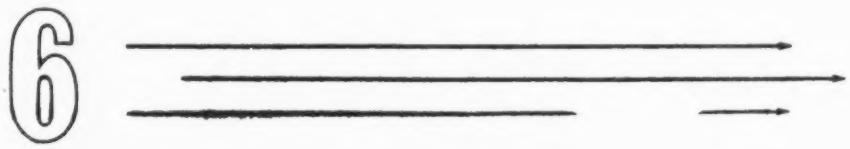
Inventory Carrying Costs must be paid to store product inventory from one cycle to the next. This cost excludes property taxes on inventory.

Materials Costs include all raw materials required to produce the product, except fuel.

The unit costs for each of these components which are applicable for a particular Industrialist for the next year are included in that player's output.

UNIT SALES PRICE

This is the price, which an Industrialist sets each cycle, at which he will sell a unit of his product. Each Industrialist has complete control over price, although the number of units he actually sells will be dependent on the relationship of his price to supply-demand conditions in the general market, and to the current average industry-wide price (reported for the last three years in the Industrialist's output).



ZONING CATEGORY

Zoning categories apply only to vacant land for APEX. Each of the six zoning categories may be developed into one or more types of land use:

ZONING CATEGORY

Zoning categories apply only to vacant land for APEX. Each of the six zoning categories may be developed into one or more types of land use:

FROM	TO
Zoning Category	Developed Land Use Type(s)
(1) R - Single-family residential	(1) R-1 (low density, high cost) (2) R-2 (medium density, medium cost) (3) R-3 (high density, low cost)
(2) M - Multiple-family residential	(4) M-1 (low density, low cost) (5) M-2 (medium density, low cost)
(3) C - Commercial	(6) CL (Commercial-Local) (7) CR (Commercial-Regional)
(4) I - Industrial	(8) I (endogenous industry) (9) I (exogenous industry)
(5) O - Bureaucratic	(10) O (exogenous bureaucratic)
(6) A - Agricultural	(11) A (active farming)

SECTION 3. AIR POLLUTION CONTROL OFFICER ROLE DESCRIPTION

The Air Pollution Control Officer (APCO) role in APEX is representative of the functions of the County Air Pollution Control Department in the "real world." The APCO is concerned with preventing or reducing harmful effects of air pollution by maintaining or improving air quality through eliminating or reducing emissions of key pollutants into the atmosphere. A major part of his success is based on his ability to develop and pursue his strategies through a judicious balance of relevant information, effective negotiation and persuasion, and carefully-designed and administered regulation. He must be able to persuade other players in APEX of the soundness of his strategies and proposals. His efforts depend upon the County Politicians, who must approve his budget and regulation proposals, and the Industrialists, both gamed and simulated, who must act to reduce actual emissions.

Like other players in the game, the APCO receives computer output at the beginning of each cycle of play. This output records the decisions made by the APCO in the previous cycle, as well as those made by the County Politicians in approving his budget and regulation proposals. The output also includes information which may guide the APCO's decisions in the next cycle.

In APEX the County is responsible for air pollution control throughout the Central City, the Suburb, and the two Townships. The Air Pollution Control Office has already been established under State enabling legislation, with specified authority and powers to carry out the air pollution control program. (A typical State law appears in the Legal Reference Manual; this manual should be consulted when questions of a legal nature arise.)

The APCO makes a budget request to the County Politicians each cycle, requesting funds which he can spend during the year. He can also initiate a proposal for Federal funds, on a three-to-one matching basis, which will be considered by the County Politicians, then approved or rejected by the Federal agency (Game Operator).

In addition to his annual budget preparation, the APCO, like all other players, must vote in the Elite Opinion Poll for his jurisdiction--the County. This includes issues raised in the newspaper for which a vote is requested as well as requests by the County Politicians for bond issues and/or special millage.

The APCO will be seeking to determine the nature and extent of air pollution problems and to build support for and compliance with an effective control program. He may discover that effective air pollution control depends as much or more on negotiation and persuasion as on the strict enforcement of regulations. The APCO can only improve air quality levels by seeking to get various sources to reduce their emissions. He will find some sources are represented by gamed Industrialists, with whom he can deal directly, and other industrial sources represented by the

computer. Also simulated are the more dispersed emissions of motor vehicles and space heating.

The APCO must develop a strategy for achieving the reduction of emissions. He can propose air pollution regulations, which must be approved by the County Politicians. He can make general recommendations on emission standards. He can try to persuade Industrialists to comply with recommendations or regulations, and he can seek to inform and educate the simulated sources and general public through expenditures for public education.

But compliance with air pollution regulations or recommendations usually involves direct capital and operating costs for the Industrialist, who may consider pollution less critical than his firm's profit picture. Politicians may be concerned with levels of industrial employment and tax base, as well as with air pollution. Developers may support pollution regulations when their opportunities for profitable land and development transactions seem to be decreased by pollution, but they will also be concerned with employment and tax base.

The APCO may want to negotiate with a specific Industrialist, to design a "reasonable" program for compliance. The Industrialist may comply by changing fuel types and rates, production capacities and rates, process rates, and control systems.

Although the APCO may seek to gain voluntary compliance with air pollution regulations, he may find that conflicts arise when Industrialists refuse to comply. In APEX the resolution of such conflicts is handled through some form of hearing or adjudication, with the Game Operator designating those to play the role of Judge or Hearing Board. Fines assessed as penalties for violation of air pollution regulations can be paid at any time by the offending Industrialist, but he can only be required to pay fines as a result of some official judgment represented in the above manner.

While the APCO is most concerned with effects of air pollution on people and property, he will generally have relatively little precise information about those effects. He will usually deal most directly with measures of air quality and source emissions. In APEX he can establish an air quality monitoring station in any analysis area to get data on levels of concentration of critical pollutants in the air. He can measure actual emissions from specific sources. And he can make plant inspections to get data about sources sufficient to estimate their emissions. All of this information will appear in the computer output in the cycle after the request is made; assuming the budget allocation is sufficient. In APEX the APCO also gets data on the level of complaints about smoke and odor from various analysis areas, and the newspaper includes complaints about specific emission sources and about general air quality. On the basis of all this data, the APCO can determine what the air pollution problems are, where they are, and what the key sources may be.

Since the major goal in air pollution control is to prevent or reduce the harmful effects of pollutants, the APCO will be concerned with air quality criteria, goals, and standards--information which comes to him from various outside public and private agencies. He can start his activities by dealing directly with complaints about smoke and odor, as clues to the most readily-evident effects. Or he may start by tackling the control of key emissions sources, which have been designated the critical polluters. Or he may start with measurements of air quality to determine more clearly the nature and extent of his pollution problems. Generally, the APCO will find that his strategy involves all of these activities in some part, but he will be limited in the amount of funds he has available to carry them out.

The APCO may find the County and City Planners his most effective allies in developing and carrying out his air pollution control program. In APEX, the Planners will be dealing primarily with public capital improvements and zoning. As a basis for their recommendations on these matters, they will be concerned with the relative locations of industrial, commercial and residential areas. They will be seeking to assist the County and City political and business leaders in improving the efficiency and quality of life for firms and residents in their jurisdictions. They will be dealing with the combined problems of waste disposal involving solid, liquid, and gaseous wastes. They will also deal with major transportation routes and traffic densities, which affect motor vehicle air pollution emissions. And they will deal with commercial areas and housing densities, which affect space heating emissions. Planners and APCO may choose to combine forces in making recommendations on zoning, traffic and transportation, and other matters which clearly influence air pollution emissions and pollution concentrations. They may be most effective in recommendations on the locations of new industries (Exofirms) coming into the City and County, especially those which will add critical pollution loads.

In summary, the APCO has several major methods available for achieving air quality goals. His time and budget may be used to:

* propose regulations limiting the emissions of critical pollutants;

* measure air quality by establishing and operating monitoring stations;

* measure the specific emissions of specific sources;

* carry out plant inspections;

* negotiate with Industrialists to gain their voluntary compliance with reasonable emission standards;

* carry out public education, administration, and enforcement programs to influence thos emission sources that are simulated as well as those that are gamed.

SECTION 4. ANNOTATED APEX WORKSHEET

The APEX Worksheet has five parts: (1) the Elite Opinion Poll, (2) the Budget Request, (3) Federal Grant Application, (4) Air Pollution Legislation, and (5) a News Release. This worksheet will serve as the official record of your agency. Space has been provided for you to record decisions over several years. At the end of each cycle, these decisions will be transferred to the computer.

I. ELITE OPINION POLL

Each year certain issues will appear in the APEX Gazette which require decisions from all role players, acting as the "elite" or power structure of the community. In some cases the decision of the elite is binding on the Politicians and the poll can be considered the same as submitting a referendum to the voters. Here the Gazette will read "DECIDED BY OPINION POLL MAJORITY." In other cases, the decision of the elite is merely advisory, and the Politicians can decide whether or not to heed their mandate. Here, the Gazette will read "POLITICIAN'S ULTIMATE DECISION BUT ELITE OPINION SOLICITED."

The outcome of the vote will be recapitulated in the next cycle's newspaper. For each issue outcome, the newspaper will also print the reactions of five pressure groups -- Civil Rights Group, Good Government League, Chamber of Commerce, Unions, and Ultra-Conservatives.

Players should vote on all issues in the Elite Opinion Poll, including those on the Business Page. Each role will have one vote. In the cases where there is more than one person in a role, an agreement must be reached.

The Elite Opinion Poll is especially important to the Politicians because their actions relative to the poll may affect their chances for re-election.

Instructions: Indicate the cycle number at the top of the page. Then put the issue number in the left hand column (this should not be confused with a project number), and the number of the alternative chosen in the adjacent column.

Example:

APCO WORKSHEET

I. ELITE OPINION POLL

Air Pollution Control Officer Cycle Number _____

ISSUE NO.	ALTERNATIVE

II. BUDGET REQUEST

A. Public Education Expenditures

Public Education is an integral part of any air pollution control program. Public Education typically covers cost associated with reports, technical meetings, news releases, conferences with Industrialists, and meetings with interested citizen's groups. The Air Pollution Control Office can develop public awareness through a good public education program, and the amount of resources expended will affect this awareness.

Instructions: Indicate the type of program in the left hand space and the requested funds in the right hand space. Then total the expenditures.

Example:

A. Public Education Expenditures

Programs	Costs
1. Television Production	5,000
2. Reports	900
3. Public Schools Program	750
Total Public Education Expenditures	6,650

B. Administration and Enforcement

Administrative activities include many of the daily operating functions of an agency. For example, they would include functions associated with the preparation of the budget, personnel matters, planning, records storage and retrieval, and so forth. The costs

under this section of the budget include a large portion of the APCO's salary, as well as the general cost of doing business, i.e., secretaries, supplies, office machines, services, accounting, etc.

Enforcement activities, on the other hand, are those associated with drafting legislation, bringing violators to trial, operation of a complaint file, building a court case, etc.

Expenditures under this budget category will affect the industries simulated in the computer, as well as those that are gamed. The APCO should bear in mind that simulated industries respond to three inputs: 1) the number of inspections and emission measurements performed on the industry, 2) the percentage deviation between the emissions of the simulated industry and the current emission regulations in the County, and 3) the stress placed on enforcement through expenditures under the budget category of administration and enforcement. For example, a simulated industry may be 100% above the current emission regulations, and be under constant inspection, but if the agency spends no funds on enforcement, the industry will continue to operate in violation of the rules and regulations of the County.

As mentioned above, this section of the budget includes a large portion of the APCO's salary. It also includes portions of the salaries of the rest of the staff. To help you in determining the staff requirements for your agency, a chart has been included (page 4-5) which demonstrates the manpower resources used in local air pollution control agencies. These were reported in Manpower and Training Needs for Air Pollution Control, Report of the Secretary of Health, Education and Welfare, August 7, 1970, U.S. Government Printing Office, Washington. D. C.

TABLE A-1.—PREDICTIVE MODEL OUTPUT FOR REQUIRED MAN-YEARS BY FUNCTION AND AGENCY TYPE

	Function	Local						State		Combined		
		Comprehensive (agencies)		Noncomprehensive (agencies)		Minimal regulatory						
		Man-years	Percent	Man-years	Percent	Man-years	Percent	Man-years	Percent	Man-years	Percent of total	Percent of subtotal
	OFFICE OF THE DIRECTOR											
1acdf	Policy, public relations, intergovernmental relations, and systems analysis	403.5	8.8	28.8	9.8	64.4	20.0	268.2	9.5	764.9	9.5	23.8
1b	Administrative and clerical support	1,085.2	23.8	77.5	26.4	64.4	20.0	720.4	25.4	1,947.5	24.3	61.0
1g	Staff training and development	202.0	4.8	15.3	5.2			145.9	5.1	381.2	4.8	12.0
1h	Statewide training operations							47.3	1.7	47.3	.6	1.4
1i	AQCR planning and evaluation							63.0	2.2	63.0	.8	1.8
	Subtotal	1,708.7	37.4	121.6	41.5	128.8	40.0	1,244.8	43.9	3,203.9	40.0	100.0
	TECHNICAL SERVICES											
2a	Laboratory operations	187.8	4.1	11.3	3.8			133.5	4.7	332.6	4.2	26.2
2b	Operation of monitoring network	214.0	4.7	20.3	6.9	64.4	20.0			298.7	3.7	23.8
2c	Data reduction and processing	159.4	3.5	3.7	1.3			143.5	5.1	306.6	3.8	24.4
2d	Special field studies	110.1	2.4	7.4	2.5			73.3	2.6	190.8	2.4	15.2
2e	Instrument maintenance and calibration	90.5	2.0	7.2	2.4			44.4	1.6	142.1	1.8	10.4
	Subtotal	761.8	16.7	49.9	17.0	64.4	20.0	394.7	13.9	1,270.8	15.9	100.0
	FIELD SERVICES											
3a	Scheduled inspections for permit renewal	556.9	12.2	46.2	15.8	64.4	20.0	366.5	12.9	1,034.0	12.9	62.0
3bc	Complaint handling and field patrol	375.2	8.2	65.5	22.4	64.4	20.0			505.1	6.3	30.0
3d	Preparation for legal actions	74.8	1.6	9.8	3.3			43.2	1.5	127.8	1.6	8.0
	Subtotal	1,006.9	22.1	121.5	41.5	128.8	40.0	409.7	14.4	1,666.9	20.8	100.0
	ENGINEERING SERVICES											
4a	Calculation of emission estimates	91.4	2.0					60.8	2.1	152.2	1.9	8.3
4b	Operation of permit system	684.9	15.0					500.9	17.7	1,185.8	14.8	63.7
4c	Source testing	161.8	3.5					124.9	4.4	286.7	3.6	15.3
4def	New regulations, engineering reports, and emergency procedures	146.5	3.2					97.7	3.4	244.2	3.0	12.7
	Subtotal	1,084.6	23.8					784.3	27.7	1,868.9	23.3	100.0
	Grand total [1]	4,562.0	100.0	293.0	100.0	322.0	100.0	2,833.5	99.9	8,010.5	100.0	

[1] Differences in man-years and number of positions reported for State and local agencies due to rounding of numbers.

Instructions: In the left hand column, list the various administrative and enforcement programs of your agency. In the right hand column, list the costs associated with these programs. Then total these costs.

Example:

B. Administration and Enforcement

Administration

Programs	Costs
1. Policy	2,000
2. Inter gov. relations	1,000
Sub Total - Administration	3,000

Enforcement

Programs	Costs
1. Preparation of Cases	2,000
Sub Total - Enforcement	2,000
Total Administration and Enforcement	5,500

C. Plant Inspections

Plant inspections are the scheduled inspections made by the agency which provide information that could be developed through a walk-through inspection. For instance, an inspector could determine 1) industry number, 2) analysis area (A.A.) location of plant, 3) process names, 4) process or fuel rate, 5) fuel type, 6) control systems, 7) smoke emission readings, and 8) odor readings. Up to 15 industries can be inspected during the year.

The cost of each plant inspection is $1,500. The $1,500 covers the cost of equipment, office space, training, secretarial cost, and miscellaneous expenses amortized over a 10 year period of time. It also includes portions of the salaries of the inspectors and engineers who carry out the inspections.

Plant inspection requests should be placed in descending order of preference, i.e., the most important plant inspection first followed by the next most important. If there are not enough funds in this budget category, plant inspections will be dropped from the list starting with those of lowest priority.

Instructions: Enter the numbers of the plants to be inspected this cycle in order of priority. The total should be multiplied by $1,500.

Example:

C. Plant Inspections

Industries in Priority of Inspection															No. of Insp.	Cost Insp	Total Cost this Cycle
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
11	12														2	$1,500	$3,000

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PRINCIPLES OF AIR POLLUTION CONTROL TEAM 1

PLANT INSPECTION AND EMISSION MEASUREMENT RESULTS

IND NO.	AA	PROCESS NAME	PROCESS OR FUEL RATE	FUEL TYPE	MAX.PRODUCTION CAPACITY	CONTROL SYSTEM	ODOR	EMISSION RATES (LBS/HR) SMOKE	PARTS	SO2	CO	NOX	HC
11	4	BAKING COATINGS	400 TONS/HOUR		500 CARS/DAY	0 0 0	0	R-0					
12	4	BAKING COATINGS	175 TONS/DAY		200 CARS/DAY	44 0 0	0	R-0					

CONTROL SYSTEMS NOT IN OPERATION

44 DIRECT FLAME AFTERBURNER

D. Emission Measurements

Emission measurements involve source testing and they require a sophisticated team of engineers and chemists. They also require more extensive equipment and laboratory services and involve a longer sampling time than that needed for plant inspections. For this reason, the cost of an emission measurement is twice that of a plant inspection.

The $3,000 cost for each emission measurement is based on an amortized cost for a beginning agency over a ten year period. As with a plant inspection, the sum indicated here includes salaries of engineers, chemists, etc., who are involved in taking emission measurements.

An emission measurement provides the same preliminary information as the plant inspection, so it is unnecessary to order a plant inspection when ordering an emission measurement.

Emission measurements will provide all of the information listed for plant inspections, plus 1) emission rates in pounds per hour for Particulates, SO_2, CO, NO_x and HC and 2) any violations of the State or County regulations, including the number of days in violation.

Information obtained through a plant inspection or an emission measurement may be used as evidence in court.

As with plant inspections, emission measurements should be listed in order of priority. If funds are not sufficient to cover all the measurements requested, the ones of lowest priority will be dropped from the list first. There is a maximum of fifteen emission measurements that can be ordered each cycle.

Instructions: *Enter the numbers of the plants to receive emission measurements in order of priority. Multiply the number of measurements requested by $3000 to get the total cost.*

Example:

D. Emission Measurements

Industries in Priority of Emission Measure.															No. of E.M.	Cost E.M.	Total Cost this Cycle
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
6															1	$3000	$3000

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PRINCIPLES OF AIR POLLUTION CONTROL TEAM 1

PLANT INSPECTION AND EMISSION MEASUREMENT RESULTS

IND	AA	PROCESS NAME	PROCESS OR FUEL RATE	FUEL TYPE	MAX.PRODUCTION CAPACITY	CONTROL SYSTEM				ODOR	EMISSION RATES (LBS/HR) SMOKE	PARTS	SO2	CO	NOX	HC
6	23	COMBUSTION	8 TONS/HOUR	LO COAL	12237 BBLS/DAY	0	0	0	0	R-5	1713	1550	0	286	0	
6	23	BALL MILLS	33 TONS/HOUR		12237 BBLS/DAY	0	0	0	0	R-0	6000	0	0	0	0	
6	23	KILNS	33 TONS/HOUR		12237 BBLS/DAY	0	0	0	0	R-0	2000	0	0	0	0	
6	23	CAR LOADING	33 TONS/HOUR		12237 BBLS/DAY	0	0	0	0	R-0	100	0	0	0	0	
1	4	BAKING COATINGS	400 TONS/HOUR		500 CARS/DAY	0	0	0	0	R-0						
12	4	BAKING COATINGS	175 TONS/DAY		200 CARS/DAY	44	0	0	0	R-0						

CONTROL SYSTEMS NOT IN OPERATION

44 DIRECT FLAME AFTERBURNER

E. Air Quality Monitoring Stations - Purchase, Upgrade, and Operation

Monitoring stations for ambient air can provide information on the general air quality of an area. There are 29 possible sampling points within the County, one in each analysis area (AA). These locations (which appear on the workmap) provide protection for the equipment, ready accessibility, a supply of electricity, and they are clear of obstructions. Once a monitoring station is established it cannot be moved. For this reason, care should be taken in the selection of monitoring station locations. Factors that should be considered include meteorology, topography, growth potential, and the types of contaminants involved.

There are five types of stations available for use in this exercise: Type 1 samples just suspended particulates; Type 2 samples particulates and SO_2; Type 3 samples particulates, SO_2, and Carbon Monoxide; Type 4 samples particulates, SO_2, CO and Oxides of Nitrogen; Type 5 samples particulates, SO_2, CO, and NO_x and Hydrocarbons.

A monitoring station can be operated at any level below the established level. For example, a Type 5 station (one that monitors particulates, SO_2, CO, NO_x and HC) may be operated as a Type 4, a Type 3, a Type 2 or a Type 1 station. (It is also possible to own a station and not operate it at all). This is done by simply choosing the appropriate operating costs. It is also possible to upgrade a monitoring station by paying an additional operaing cost, as well as an upgrade cost.

The following table (shown on page 4-9) should be used in determining the original purchase price, the upgrade costs, and the operating costs for the various types of monitoring stations.

When a monitoring station is installed and operating in an analysis area, the following information will appear on the computer printout for the APCO role: 1) the mean micrograms per cubic meter for particulates or for other pollutants the parts per million (ppm) for each quarter, 2) the micrograms per cubic meter or parts per million for the worst day for each quarter, and 3) the number of days above a certain report reporting level specified by the APCO. This reporting level is generally tied to the air quality goals or standards for the particular pollutant.

In summary, there are three types of decisions involving monitoring stations. The first concerns the choice of the analysis area in which to locate the station. The second involves the type of equipment to be purchased and operated in an analysis area. And the third involves the selection of a reporting level for each pollutant to be measured.

Instructions: Enter the analysis area, the type of station to be operated, the purchase or upgrade cost, and the operating costs for each monitoring station. Then assign a priority to each station. (This will determine which ones are to be operated in case of insufficient funds.) Finally, enter a reporting level for each pollutant to be measured.

Example:

1. Cost Associated with A.Q. Monitoring Station

Type of Station	Pollutants Monitored	Original Purchase Price	Upgrade to				Oper. Cost
			Type 2	Type 3	Type 4	Type 5	
Type 1	Particulates	500	2,300	5,800	11,800	14,900	2,100
Type 2	Part + SO_2	2,800	-	3,500	9,500	12,600	4,500
Type 3	Type 2 + CO	6,300	-	-	6,000	9,100	6,600
Type 4	Type 3 + NO_x	12,300	-	-	-	3,100	9,200
Type 5	Type 4 + HC	15,400	-	-	-	-	11,550

2. Monitoring Station Operation

A.A.*	Type of Station to be operated *	Purchase or Upgrade Cost	Operating Cost	Priority for Station Operation *
7	5	15,400	11,550	1
Total		15,400	11,550	

3. Monitoring Station Reporting Levels

Particulates	SO_2	CO	NO_x	HC
100.00	0.20	3.00	0.10	3.00

F. Summary of Budget Request

Each year (cycle) a budget proposal is submitted to the County Board of Supervisors. The Board then has three options: 1) to adopt it without modification; 2) to revise it before adoption; or 3) to reject it entirely. If the budget proposal is modified, the functional budget must be rearranged to reflect the change. It is important to remember that programs will be cut to match funds alloted in the functional budget according to the priorities you have set within each functional category, i.e., plant inspection, emission measurements, and air quality monitoring stations operations.

Each year a budget proposal must also be submitted to the Federal Government, if their assistance is requested. Federal funds are available on a maximum of a three to one matching basis. Matching is based upon the totals and does not apply to the distribution among functional categories. Ordinarily, Federal grants are for a three year period. However, these grants simply involve the total maximum federal funding available, and specific functional allocation must be approved each year.

Instructions: Take the totals from each of the functional categories and place them under the corresponding headings of the Budget Summary. Then allocate the appropriate portions of the total to the County and Federal Governments. Finally, secure the signature of the authorized County Official.

Example:

F. Summary of Budget Request

	Total	County	Federal
Public Education	6,650	50	6,600
Administration & Enforce.	47,300	-	47,300
Plant Inspections	26,500	400	26,100
Emission Measurements	21,000	1,000	20,000
A.Q. Stations Upgrade	15,800	15,800	
A.Q. Stations Operation	15,800	15,800	
Total	133,050	33,050	100,000

Signature of Authorizing County Official _____

III. FEDERAL GRANT APPLICATION

Federal Funds are available to help local and state agencies in establishing and maintaining effective programs. In order to receive funds, formal presentation must be made to the federal representative in the game. (The Game Director will see that you have access to this representative.) Funds are granted just prior to the cycle in which funds are to be used, however, you should lay the ground work several cycles before the need arises. If additional funds are needed during the usual three year grant period, supplementary funds may be received by making a request to the federal representative. Details on air pollution grants may be found by consulting the Game Director.

Instructions: *Enter the funds authorized by the federal representative in the spaces under each cycle in which the funds are to be granted, for either regular or supplementary grants.*

Example:

III. Federal Grant Application

Approved Federal Funds in $.	Cycle 1	Cycle 2	Cycle 3
1. Original	40,723	0	0
2. Supplemental	0	0	---

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PRINCIPLES OF AIR POLLUTION CONTROL TEAM 1

FUNDS SPENT IN CYCLE 1

	COUNTY	FEDERAL	TOTAL
A. PUBLIC EDUCATION	$ 500.	$ 0.	$ 500.
B. ADMINISTRATION AND ENFORCEMENT	10000.	0.	10000.
C. PLANT INSPECTIONS	3000.	0.	3000.
D. EMISSION MEASUREMENTS	0.	3000.	3000.
E. A.Q. MONITORING STATIONS -- PURCHASE AND UPGRADE	2500.	0.	2500.
F. A.Q. MONITORING STATIONS -- OPERATION	2500.	0.	2500.
TOTAL FUNDS AVAILABLE THIS YEAR	$ 18500.	+ $ 3001.	= $ 21501.

FEDERAL FUNDS AVAILABLE (ON A 3-FOR-1 BASIS) FOR NEXT TWO CYCLES = CYCLE 2 $ 0.
CYCLE 3 $ 0.
TOTAL FOR TWO YEARS $ 0.

IV. AIR POLLUTION LEGISLATION

The APCO may be involved in developing legislation on two levels. First, proposals may be sent to the State Legislature for new State regulations concerning air pollution. The State will take into consideration any proposals coming from APEX County, but it should be recognized that APEX is only one of many counties in the State. Any change in State Legislation will be reported on the APCO computer printout, and through the News Media. (The Legal Reference Manual should be consulted for information concerning legislation at the start of the game).

The APCO may also work on the local level and concentrate on having legislation approved by the County Board of Supervisors. It is important to remember that all local regulations can be approved only after a public hearing is held on the ordinance (see Enabling Legislation in the Legal Reference Manual). The County Board must formally adopt a regulation before it becomes a law.

This section of the worksheet gives you the opportunity to recommend regulations covering Particulates, SO_2, CO, NO_x, and HC in either pounds of pollutant per hour of operation, or in pounds of pollutant per 1000 pounds of production (or if a fuel process, per 1000 pounds fuel used). The worksheet also has space to recommend regulations covering smoke emissions in Ringelmann numbers and odor emissions in Stinkelmann numbers (see Glossary for definition). A recommendation on the maximum daily fine level for violation of these regulations may also be made. This recommendation should not exceed the State statutory limit of $500 per offense and six months in the County Jail (see Legal Reference Manual).

If the categories for legislation on the worksheet do not meet your needs, it is not necessary to use them. You may develop any type of ordinance structure that best enables you to carry out your control strategy. However, the computer printout will reduce the work required to check for possible air pollution control regulation violators if the ordinance is expressed in terms of maximum permissible emissions in pounds of pollutants per hour or in pounds of emissions per 1000 pounds of finished materials (or in the case of fuel, pounds per 1000 pounds of fuel used).

Instructions: In section A fill in the appropriate categories for proposed County Regulations. Then obtain the signature of the authorized County Board Official if the regulations are approved after a public hearing.

Then use section B to make any recommendations to the State for air pollution legislation.

Example:

A. County Regulations

Initial of Co. Board	Max. Fine Level	lbs/Hr.					lbs/1000 lbs Prod.						
		Part	SO_2	CO	NO_x	HC	Part	SO_2	CO	NO_x	HC	Smoke	Odor
	200	150					4					3	2

B. Recommendations to State for Regulations

	250											2	2

V. NEWS RELEASE

Each cycle you must report your activities to the community. This is accomplished by making a news release on the news release forms.

Instructions: Develop and write a news release or publication. The results will be transcribed by your role assistant for newspaper input.

Example: The results of your input will be printed in the newspaper as follows:

APCO NEWS RELEASE
for Cycle 2

This year the Air Pollution Control District succeeded in prosecuting three firms for violation of the air pollution control ordinance. The reduction in pollution was .....

METRO-NEX NEWS

TEAM 1, EDITION 2 THURSDAY, SEPTEMBER 9, 1971 PRINCIPLES OF AIR POLLUTION CONTROL

THIS YEAR THE AIR POLLUTION CCATRCL CISTRICT SUCCEECEC IN PROSICUTING THREE FIRMS FOR VIOLATION OF THE AIR POLLUTION CONTRCL CRDINANCE. THE RECUCTION IN AIR POLLUTION WAS .....

NATIONAL NEWS HEADLINES

A RECORD NUMBER OF STRIKES IN ALTCMCBILE, STEEL AND NEWSPAPER INCUSTRIES APING PRODUCTION BELOW POTENTIALS.

STOCK MARKET FALTERS IN FOURTH CUARTER AFTER HITTING RECORD HIGH IN THIRD QUARTER.

STUCY BY URBAN ECONOMISTS INDICATES OUR CENTRAL CITIES HAVE BEEN UNDER-INVESTED IN FCR FIFTY YEARS. OUP CUPRENT PROBLEMS SHOW A HALF-CENTURY CF NEGLECT AND BAD MANAGEMENT.

ADMINISTRATION ANNOUNCES SHIFT IN ATTENTICN TC PRCBLEMS CF CITIES-NEW LEGISLATICN IS IN CONGRESSIONAL CUMMITTEES.

DESALINATION WILL NOT SCLVE NATICN'S WATER FRCBLEMS, FECERAL OFFICIALS WARN. INCREASED POLLUTION ARATEMENT FFFORTS BY LOCAL GOVERNMENTS ARE NEEDED TO EXPAND WATER SUPPLY.

REGIONAL OFFICE OF F.H.A. ANNOUNCES SURVEY AND PLANNING GRANTS FOR URBAN RENEWAL-METROPOLIS INCLUDED, RECEIVING GRANT FCR INDUSTRIAL RENEWAL IN AA6, LONG-AWAITED BY ELEMENTS OF BUSINESS CCMMUNITY. PLANNING MEETINGS TO BE SCHEDULED.

U. S. UNEMPLCYMENT RATE THE PAST YEAR WAS 4.0 PERCENT

SECTION 5. APCO WORKSHEET

I. ELITE OPINION POLL

Air Pollution Control Officer Cycle Number _____

ISSUE NO.	ALTERNATIVE

Air Pollution Control Officer Cycle Number _____

II. BUDGET REQUEST

A. Public Education Expenditures

	Programs	Costs
1.		
2.		
3.		
4.		
5.		
6.		

Total Public Education Expenditures $_____

B. Administration and Enforcement

Administration

	Programs	Costs
1.		
2.		
3.		
4.		
5.		
6.		

Sub Total - Administration $_____

Enforcement

	Programs	Costs
1.		
2.		
3.		
4.		
5.		
6.		

Sub Total - Enforcement $_____

Total - Administration & Enforcement $_____

C. Plant Inspections

Industries in Priority of Inspection*															No. of Insp.	Cost Insp	Total Cost this Cycle
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
																$1,500	

D. Emission Measurements

Industries in Priority of Emission Measure*															No. of E.M.	Cost E.M.	Total Cost this Cycle
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
																$3,000	

E. Air Quality Monitoring Stations - Purchase, Upgrade, and Operation

1. Cost Associated with A.Q. Monitoring Station

Type of Station	Pollutants Monitored	Original Purchase Price	Upgrade to				Oper. Cost
			Type 2	Type 3	Type 4	Type 5	
Type 1	Particulates	500	2,300	5,800	11,800	14,900	2,100
Type 2	Part + SO_2	2,800	-	3,500	9,500	12,600	4,500
Type 3	Type 2 + CO	6,300	-	-	6,000	9,100	6,600
Type 4	Type 3 + NO_x	12,300	-	-	-	3,100	9,200
Type 5	Type 4 + HC	15,400	-	-	-	-	11,550

2. Monitoring Station Operation

A.A.*	Type of Station to be operated	Purchase or Upgrade Cost	Operating Cost	Priority for Station Operation*

Total _____

3. Monitoring Station Reporting Levels

Particulates*	SO_2*	CO	NO_x*	HC*

F. Summary of Budget Request

	Total	County*	Federal*
Public Education			
Administration & Envorce.			
Plant Inspections			
Emission Measurements			
A.Q. Stations Upgrade			
A.Q. Stations Operation			
Total			

Signature of Authorizing County Official _____

III. FEDERAL GRANT APPLICATION

Approved Federal Funds in $.	Cycle*	Cycle*	Cycle*
1. Original			
2. Supplemental			

IV. AIR POLLUTION LEGISLATION

A. County Regulations

Initial of Co. Board	Max. Fine Level*	Part	Lbs/Hr.*			Lbs/1000 Lbs Prod.*					Smoke Odor*
			SO_2	CO	NOX	Part	SO_2	CO	NO_x	HC	

B. Recommendations to State for Regulations

Cycle Number _____

V. NEWS RELEASE

The following should be printed in the APEX Gazette: (please write clearly)

NAME _____ ROLE _____

SECTION 6. BACKGROUND INFORMATION FOR APCO ROLE

1. Climatological Summary

The climatology of this region is characterized by an average annual temperature of 54.3° F and an average annual precipitation of 41.23 inches. There is a prevailing south-westerly wind with a mean hourly speed of 9.6 miles per hour. In Figure 1 there are wind roses which represent 10 years of weather observations taken from the airport in analysis area 29. Each line in the wind rose is a vector which represents the percent of time or the speed in miles per hour that the wind travels in a particular direction. (The direction of the vector is toward the center of the wind rose.) Inversion frequency is also presented in Figure 1.

Figure 2 contains information on degree days in APEX County. A degree day is defined as the difference between the average temperature for the day and the base temperature in degrees Fahrenheit. In APEX, the base temperature has been set at 65° F. As an example, if the average temperature on January 31 is 32° F, then the degree day would be 65° F - 32° F, or 33° F. The concept of degree day was developed to aid in calculating the space heating requirements under different weather condition.

2. Topography

The topography of APEX County is typical of the areas of the North Central United States. The area is characterized as flat with no sharp breaks in topography. The most prominent topographical feature is the Red Cedar River which joins the Grant River in the heart of town, and continues to flow toward the east. As a result of glacial deposits several unusual soils are found in this area which are ideally suited for vegetable crops as lettuce, tomatoes, beans, and alfalfa.

3. List of Major Industries

The Chamber of Commerce has published lists containing information about the major industries in APEX County. These lists are included as Figures 3, 4 and 5 and they record the location, the name, the number, and the initial production capacity of 40 major industries.

4. Emission Factors

Emission factors are used to make very rough estimates of the pollution emitted from uncontrolled air pollution sources. The emission factors recorded in Figures 6 and 7 have been specifically adapted for use in the APEX game and should not be used elsewhere.

To calculate the emissions from a combustion process, Figure 6 should be consulted. The appropriate emission factor should be multiplied by the fuel use rate for that industry. For example, if

the Pulp Plant uses high grade oil, the appropriate emission factor for particulates is in the range of .12 to .18 pounds of particulates per barrel of oil. A figure in this range is multiplied by the fuel rate which is obtained when a plant inspection or emission measurement is ordered. The particulate emissions are then calculated as follows:

$$\frac{.15 \text{ lbs. Part.}}{\text{bbl oil}} \times \frac{48 \text{ bbl oil}}{\text{hour}} = \begin{array}{l}7.2 \text{ lbs/hr. Particulates} \\ \text{for the combustion process}\end{array}$$

If the fuel rate is not known, it can be estimated by consulting Figure 8, the properties of fuels used in APEX County.

To calculate emission from a production process, Figure 7 should be used. In this case the emission factor for the appropriate type of industry is multiplied by the process rate. For example, to calculate particulate emissions from the Pulp Plant, an emission factor in the range of $\frac{14 \text{ to } 16 \text{ lbs/hr}}{\text{tons/day}}$ is used. This is multiplied by a process rate of 300 tons/day for the recovery process. The emissions are then as follows:

$$\frac{15 \text{ lbs/hr Part.}}{\text{tons/day}} \times 300 \text{ tons/day} = \begin{array}{l}4500 \text{ lbs/hr Particulates} \\ \text{for the recovery process}\end{array}$$

5. Properties of Fuels Used in APEX County

Figure 8 contains data on fuels presently used in APEX County. This data can be important in determining emissions from the combustion process of an industry. It can also be used to estimate the effects of a fuel change. For example, if a combustion process used 40 bbl/hr of "lo-grade" oil with a heating value of 4.2×10^6 BTU/bbl, a total of 168×10^6 BTU/hr are being generated. A simple equation for fuel change would be present fuel use rate (fuel units/unit of time) x heating value of present fuel (BTU/fuel unit) = unknown fuel use rate (fuel units/unit time) x heating value of proposed fuel (BTU/fuel unit). It should be noted that the heat generated by a combustion process can be used for many purposes, irrespective of the fuel used by the process.

6. Line Sources

Automobile traffic is considered a line source. There are approximately 2.1 people per registered automobile in APEX County in Cycle 1. Gasoline sales for Cycle 1 indicate 1.9 gallons of gasoline are used per auto per day. Figure 9 which is taken from Ozolins and Smith, presents emission factors for gasoline and diesel engines.

7. Control Equipment

Each industry may install air pollution control equipment. Figure 10 presents general information on control systems, and Figure 11 contains the expected annual control costs relative to capacity and shipments of industrial process sources. However, the exact equipment size, efficienty, and cost of a control device for a particular industry can only be obtained when that industry orders a consultant survey.

8. Area Sources

Space heating is a major source of pollution from area sources. Each of the five household types is considered to use a characteristic fuel, i.e. - the low income group uses the lowest quality and the higher income uses natural gas heating. For calculation methods you should consult Guntis Ozolins and Raymond Smith, A Rapid Survey Technique for Estimating Community Air Pollution Emissions, Public Health Service (No. 999-AP-29).

Figure 1. WIND ROSES BY SEASONS

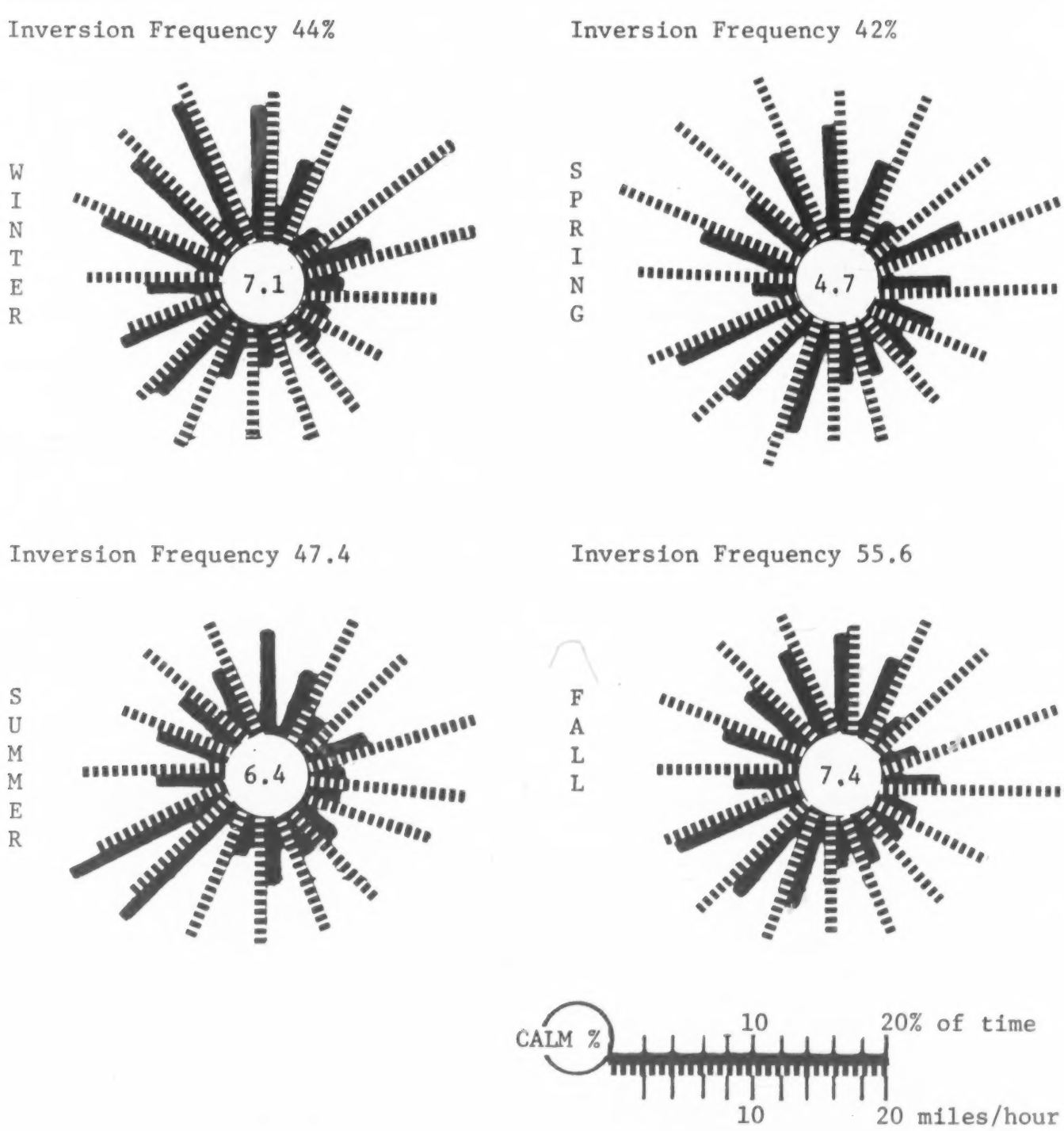


Figure 2. DEGREE DAYS FOR APEX COUNTY BY MONTH*

J	F	M	A	M	J	JL	A	S	O	N	D	ANNUAL
986	907	704	402	104	0	0	0	47	269	573	902	4,866

*a degree day is defined as the difference between the average temperature for the day and a base temperature (65° for APEX).

Figure 3

CHAMBER OF COMMERCE
LIST OF MAJOR INDUSTRIES BY INDUSTRY NUMBER

INDUSTRY NUMBER	INDUSTRY NAME	INITIAL PRODUCTION	LOCATION (A.A.)
1	Shear Power Company	500 Megawatts	8
2	Peoples' Pulp Plant	300 Tons/Day	2
3	Rusty's Iron Foundry	50 Tons/Day	5
4	Industrial Development Site		
5	Caesar's Rendering Plant	23 Tons/Day	12
6	Dusty Rhodes Cement Company	12,500 BBLS/Day	23
7	Industrial Development Site		
8	City Waste Disposal Site	250 Tons/Day	
9	City Dump - East	250 Tons/Day	15
10	City Dump - West	250 Tons/Day	26
11	Auto Assembly Able	500 Cars/Day	4
12	Auto Assembly Baker	200 Cars/Day	4
13	Auto Assembly Charlie	100 Cars/Day	6
14	Wolverine Forging Plant	200 Tons/Day	7
15	Finch's Forging Plant	200 Tons/Day	6
16	Smithy's Forging Plant	200 Tons/Day	2
17	Ahead Forging Plant	200 Tons/Day	6
18	Wordy Printing Compnay	18,000 Feet/Hr	6
19	Bogus Printing Company	18,000 Feet/Hr	6
20	Boylan's Fertilizer	180 Tons/Day	
21	Peter's Water Heaters	700 Shells/Day	7
22	Tar Heel Asphalt Paving	1,600 Tons/Day	8
23	Concrete Batching	1,600 Tons/Day	12
24	Spartan Galvanizing Company	24 Tons/Day	8
25	Monkey Brass Melting Company	14 Tons/Day	5
26	Trojan Varnish Manufacturing	660 Gal/Day	10
27	Hannah Feed and Grain	360 Tons/Day	1
28	La Rue Soap and Detergent	480 Tons/Day	1
29	Acme Dry Cleaning	800 Lbs/Day	4
30	Trojan Dry Cleaning	800 Lbs/Day	7
31	Lostend Foundry - Iron	50 Tons/Day	5
32	Dusty's Cement Products	12,500 BBLS/Day	3
33	Rembrandt's Rendering Facility	23 Tons/Day	27
34	Wiffenpoof Fertilizer	180 Tons/Day	1
35	Saint Andre Asphalt Paving	1,600 Tons/Day	15
36	Oriental Concrete Batching	1,600 Tons/Day	20
37	Daily Journal Printing	18,000 Feet/Hr	7
38	Tiger Body Assembly	500 Autos/Day	3
39	Academic Feed and Grain	360 Tons/Day	13
40	Spotless Dry Cleaning	800 Lbs/Day	11

Figure 4

CHAMBER OF COMMERCE
LIST OF MAJOR INDUSTRIES BY ANALYSIS AREA

LOCATION (A.A.)	INDUSTRY NAME	PRODUCTION CAPACITY	INDUSTRY NUMBER
1	Hannah Feed and Grain	360 Tons/Day	27
1	LaRue Soap and Detergent	480 Tons/Day	28
1	Wiffenpoof Fertilizer	180 Tons/Day	34
2	Smithy's Forging Plant	200 Tons/Day	16
2	Boylan's Fertilizer	180 Tons/Day	20
2	Peoples' Pulp Plant	300 Tons/Day	2
3	Dusty's Cement Products	12,500 BBLS/Day	32
3	Tiger Body Assembly	500 Autos/Day	38
4	Auto Assembly Able	500 Cars/Day	11
4	Auto Assembly Baker	200 Cars/Day	12
4	Acme Dry Cleaning	800 Lbs/Day	29
5	Rusty's Iron Foundry	50 Tons/Day	3
5	Monkey Brass Melting Company	14 Tons/Day	25
5	Lostend Foundry	50 Tons/Day	31
6	Auto Assembly Charlie	100 Cars/Day	13
6	Finch's Forging Plant	200 Tons/Day	15
6	Ahead Forging Plant	200 Tons/Day	17
6	Wordy Printing Company	18,000 Feet/Hr.	18
6	Bogus Printing Company	18,000 Feet/Hr.	19
7	Wolverine Forging Plant	200 Tons/Day	14
7	Peters Water Heaters	700 Shells/Day	21
7	Trojan Dry Cleaning	800 Lbs/Day	30
7	Daily Journal Printing	18,000 Feet/Hr.	37
8	Shear Power Company	500 Megawatts	1
8	Tar Heel Asphalt Paving	1,600 Tons/Day	22
8	Spartan Galvanizing Company	24 Tons/Day	24
10	Trajan Varnish Manufacturing	660 Gal/Day	26
11	Spotless Dry Cleaning	800 Lbs/Day	40
12	Caesar's Rendering Plant	23 Tons/Day	5
12	Concrete Batching	1,600 Tons/Day	23
13	Academic Feed and Grain	360 Tons/Day	39
15	City Dump - East	250 Tons/Day	9
15	Saint Andre Asphalt Paving	1,600 Tons/Day	35
20	Oriental Concrete Batching	1,600 Tons/Day	37
23	Dusty Rhodes Cement Company	12,500 BBLS/Day	6
26	City Dump - West	250 Tons/Day	10
27	Rembrandts Rendering Facility	23 Tons/Day	33

Figure 5

CHAMBER OF COMMERCE
LIST OF MAJOR INDUSTRIES BY TYPE

INDUSTRY NUMBER	INDUSTRY NAME	PRODUCTION CAPACITY	LOCATION (A.A.)
	FOOD AND AGRICULTURAL		
27	Hannah Feed and Grain	360 Tons/Day	1
39	Academic Feed and Grain	360 Tons/Day	13
5	Caesar's Rendering Plant	23 Tons/Day	12
33	Rembrandt's Rendering Facility	23 Tons/Day	27
	PRINTING AND PUBLISHING		
18	Wordy Printing Company	18,000 Feet/Hr	6
19	Bogus Printing Company	18,000 Feet/Hr	6
37	Daily Journal Printing	18,000 Feet/Hr	7
	CHEMICAL PROCESS INDUSTRY		
26	Trojan Varnish Manufacturing	660 Gal/Day	10
20	Boylan's Fertilizer	180 Tons/Day	2
34	Wiffenpoof Fertilizer	180 Tons/Day	1
28	LaRue Soap and Detergent	480 Tons/Day	1
	MINERAL PRODUCTS INDUSTRY		
22	Tar Heel Asphalt Paving	1,600 Tons/Day	8
35	Saint Andre Asphalt Paving	1,600 Tons/Day	15
6	Dusty Rhodes Cement Company	12,500 Bbls/Day	23
32	Dusty's Cement Products	12,500 Bbls/Day	3
23	Concrete Batching	1,600 Tons/Day	12
36	Oriental Concrete Batching	1,600 Tons/Day	20
	METALLURGICAL INDUSTRY PRIMARY METALS INDUSTRY		
	SECONDARY METALS INDUSTRY		
3	Rusty's Iron Foundry	50 Tons/Day	5
31	Lostend Foundry	50 Tons/Day	5
25	Monkey Brass Melting Company	14 Tons/Day	5
24	Spartan Galvanizing Company	24 Tons/Day	8
17	Ahead Forging Plant	200 Tons/Day	6
15	Finch's Forging Plant	200 Tons/Day	6
16	Smithy's Forging Plant	200 Tons/Day	2
14	Wolverine Forging Plant	200 Tons/Day	7

(Continued on next page)

Figure 5 (cont.)

INDUSTRY NUMBER	INDUSTRY NAME	PRODUCTION CAPACITY	LOCATION (A.A.)
	FABRICATION OF METAL PRODUCTS		
11	Auto Assembly Able	500 Cars/Day	4
12	Auto Assembly Baker	200 Cars/Day	4
13	Auto Assembly Charlie	100 Cars/Day	6
38	Tiger Body Assembly	500 Auto/Day	3
21	Peters Water Heaters	700 Shells/Day	7
	PULP AND PAPER INDUSTRY		
2	Peoples Pulp Plant	300 Tons/Day	5
	SOLVENT EVAPORATION AND GASOLINE MARKETING		
29	Acme Dry Cleaning	800 Lbs/Day	4
40	Spotless Dry Cleaning	800 Lbs/Day	11
30	Trojan Dry Cleaning	800 Lbs/Day	7
	POWER PRODUCTION		
1	Shear Power Company	500 Megawatts	8
	REFUSE DISPOSAL		
9	City Dump - East	250 Tons/Day	15
10	City Dump - West	250 Tons/Day	26

Figure 6

EMISSION FACTORS FOR INDUSTRIES IN APEX

Combustion Process
(Uncontrolled)

FUEL TYPE	PARTICULATES	SO_2	NO_x	SMOKE
1. Low Grade Coal	200 - 220 lbs. ton coal	180 - 200 lbs. ton coal	30 - 40 lbs. ton coal	.012R - .023R ton coal
2. High Grade Coal	80 - 100 lbs. ton coal	40 - 50 lbs ton coal	20 - 30 lbs. ton coal	.010R - .015R ton coal
3. Low Grade Oil	.35 - .50 lbs. bbl oil	11 - 14 lbs. bbl oil	5 - 7 lbs. bbl oil	.010R - .015R bbl oil
4. High Grade Oil	.12 - .18 lbs. bbl oil	2.5 - 3.5 lbs. bbl oil	1.8 - 2.2 lbs. bbl oil	
5. Natural Gas		.018 - .022 lbs. MCF gas*	.18 - .22 lbs. MCF gas	

*MCF = Thousands of Cubic Feet

EMISSION FACTORS FOR INDUSTRIES IN APEX
Production Process
(Uncontrolled)
Figure 7

EMISSION FACTORS FOR INDUSTRIES IN APEX
Production Process (Uncontrolled)
Figure 7

INDUSTRY TYPE	PARTICULATES	SO_2	CO	NO_x	
Pulp	14-16 lbs/hr tons/day	.45-.60 lbs/hr tons/day		.12-.15 lbs/hr tons/day	
Foundry	7-10 lbs/hr tons/day	.12-.15 lbs/hr tons/day	32-35 lbs/hr tons/day		
Cement	.8-.9 lbs/hr bbl/day				
Copper	1.5-2.5 lbs/hr tons/day	200-220 lbs/hr tons/day			
Rendering					
Incinerator	.5-.6 lbs/hr tons/day	.10-.12 lbs/hr tons/day		1.10-1.12 lbs/hr tons/day	.10- t
Dump	2.0-2.2 lbs/hr tons/day	.10-.12 lbs/hr tons/day			12- t
Auto Assembly				.05-.06 lbs/hr cars/day	2- c
Forging Plant	.002-.003 lbs/hr tons/day			.006-.007 lbs/hr tons/day	
Printing				.0006-.0007 lbs/hr 1000 ft/day	.5- 10(

ON FACTORS FOR INDUSTRIES IN APEX
uction Process (Uncontrolled)
Figure 7

CO	NO_x	HC	SMOKE	ODOR
	.12-.15 lbs/hr tons/day		.003-.006R tons/day	.014-017S tons/day
32-35 lbs/hr tons/day			.02-.03R tons/day	.02-.03S tons/day
			.13-.17R tons/day	.18-.22S tons/day
1.10-1.12 lbs/hr tons/day	.10-.12 lbs/hr tons/day		.004-.006R tons/day	.008-.010S tons/day
	12-14 lbs/hr tons/day		.012-.016R tons/day	.016-.020S tons/day
.05-.06 lbs/hr cars/day	2-3 lbs/hr cars/day			
.006-.007 lbs/hr tons/day				
.0006-.0007 lbs/hr 1000 ft/day	.5-.6 lbs/hr 1000 ft/day			

(Continued on next page)

EMISSION FACTORS FOR INDUSTRIES IN APEX
Production Process
(Uncontrolled)
Figure 7 (continued from page 6-11)

(Continued from page 6-11)

EMISSION FACTORS FOR INDUSTRIES IN APEX
Production Process
(Uncontrolled)
Figure 7

INDUSTRY TYPE	PARTICULATES	SO_2	CO	NO_x	
Fertilizer	.18-.22 lbs/hr tons/day			.001-.002 lbs/hr tons/day	
Water Heaters				.0002-.0003 lbs/hr shells/day	.0015-.(shel
Asphalt Paving	1.0-1.5 lbs/hr tons/day			.0010-.0015 lbs/hr tons/day	
Concrete Batching	.003-.004 lbs/hr tons/day				
Galvanizing	.04-.05 lbs/hr tons/day			.008-.012 lbs/hr tons/day	
Brass Melting	.9-1.2 lbs/hr tons/day			.010-.015 lbs/hr tons/day	
Varnish	.0005-.0007 lbs/hr gallons/day			.0002-.0004 lbs/hr gallons/day	.0010-.(gal
Feed & Grain	.9-1.2 lbs/hr tons/day				
Dry Cleaning					.007-.(lb
Soap & Detergent	.55-.65 lbs/hr tons/day			.005-.006 lbs/hr tons/day	

TORS FOR INDUSTRIES IN APEX
roduction Process
(Uncontrolled)
Figure 7

O	NO_x	HC	SMOKE	ODOR
	.001-.002 lbs/hr tons/day		.02-.03R tons/day	
	.0002-.0003 lbs/hr shells/day	.0015-.025 lbs/hr shells/day		
	.0010-.0015 lbs/hr tons/day		.0025-.0035R tons/day	
	.008-.012 lbs/hr tons/day		.18-.22R tons/day	
	.010-.015 lbs/hr tons/day		.10-.15R tons/day	
	.0002-.0004 lbs/hr gallons/day	.0010-.0014 lbs/hr gallons/day		
		.007-.008 lbs/hr lbs/day		
	.005-.006 lbs/hr tons/day		.008-.011R tons/day	

Figure 8

PROPERTIES OF FUELS USED IN APEX COUNTY

NAME OF FUEL	FUEL NO.	% SULFUR	% ASH	BTU/UNIT HEATING VALUE	UNIT	COST IN $ PER UNIT
Lo Coal (Low Grade)	1	4.4	10.0	1.8×10^7	Tons	$7.00
Hi Grade (High Grade)	2	1.2	5.5	2.0×10^7	Tons	$9.00
Lo Oil (Low Grade)	3	1.6	1.0	4.2×10^6	BBL	$1.50
Hi Oil (High Grade)	4	0.4	0.5	4.5×10^6	BBL	$2.30
Natural Gas	5	0	0	6.0×10^5	MCF (1000 cu.ft.)	$0.50
Electricity	6	0	0	3.3×10^3	KWH	$0.005

Figure 9

EMISSION FACTORS FOR GASOLINE
AND DIESEL ENGINES (LB./1,000 GAL.)

Pollutant	Gasoline Engines	Diesel Engines
Aldehydes	4	10
Benzo (a) Pyrene	.03 gram/1,000 Gal.	0.4 gram/1,000 Gal.
Carbon Monoxide	2,910	60
Hydrocarbons	524	180
Oxides of Nitrogen	113	222
Oxides of Sulfur	9	40
Ammonia	2	N.A.
Organic Acids	4	31
Particulates	11	110

Figure 10

GENERAL CONTROL SYSTEMS INFORMATION

SOURCE TYPE	TYPE OF CONTROL SYSTEM	INITIAL INVESTMENT COST	ANNUAL OPERATING COST	CONTROL EFFICIENCY FACTORS
PARTICULATES				
Power	Scrubber	$1,000,000-2,000,000	$180,000-230,000	87-92%
Pulp	Scrubber	10,000-200,000	2,000-25,000	90-99.9%
Foundry	Scrubber	10,000-20,000	3,000-6,000	80-86%
Cement	Baghouses	50,000-1,000,000	10,000-150,000	95-99.9%
Foundry	Precipitator	40,000-65,000	9,000-12,000	95-98%
Copper	Precipitator	150,000-250,000	50,000-75,000	94-98%
	Precip. & Cyclone	250,000-400,000	40,000-60,000	95-99.9%
Incinerator	Spray Chamber +	200,000-700,000	60,000-120,000	75-99.9%
SO_2 & PART.				
Power	Oxidation (Monsantic)	9,000,000-12,000,000	900,000-1,200,000	97-99.9% SO_2 87-92% PART.
SO_2				
Power	Injector	850,000-1,200,000	150,000-300,000	94-98%
Pulp	Scrubber	35,000-60,000	2,000-5,000	85-92%
Copper	Sulfur Acid Plant	2,000,000-3,000,000	200,000-400,000	85-92%
CO				
Foundry	Afterburners	1,000-30,000	1,000-20,000	95-98%
NO_x				
Power	Injector	850,000-1,200,000	150,000-300,000	18-23%
SMOKE				
Foundry	Afterburner	1,500-3,000	500-1,200	90-95%
Rendering	Afterburner	1,500-3,000	100-500	96-99.9%
ODOR				
Pulp	Precipitator	250,000-400,000	25,000-40,000	86-92%
	Oxidation	50,000-75,000	25,000-50,000	86-92%
	Vapor Sphere & Vent	35,000-60,000	3,000-6,000	97-99.9%
Foundry	Afterburner	1,500-3,000	100-500	90-95%
Rendering	Afterburners	2,000-30,000	100-1,000	97-99.9%

Figure 11

EXPECTED ANNUAL CONTROL COSTS RELATIVE TO CAPACITY AND SHIPMENTS OF INDUSTRIAL PROCESS SOURCES[a]
(1967 base; 100 metropolitan areas)

TYPE OF SOURCE	SOURCE TOTALS			COST RATIOS	
	Capacity (millions of dollars)	Value of Shipment (billions of dollars)	Annual Control Cost (millions of dollars)	Cost per Unit of Annual Capacity ($ per unit)	Cost per Unit of Shipment (percent)
Krait (sulfate) pulp plants---------- tons	4.1	0.4	2.5	0.61	0.63
Iron and steel plants---------- tons raw steel	116.0	10.5	204.0	1.76	1.94
Gray iron foundries---------- tons castings[b]	10.0	1.7	49.1	4.91	2.89
Primary nonferrous metallurgical plants--- tons[c]	3.4	0.6	23.5	6.91	3.92
Sulfuric acid plants---------- tons	24.4	0.2	2.2	0.09	1.10
Phosphate fertilizer plants---------- tons P_2O_5	3.5	0.4	5.5	1.57	1.39
Petroleum refineries---------- barrels	2530.0	13.5	1.4	0.00	0.01
Asphalt batching plants---- tons paving mixture[d]	250.0	0.6	18.6	0.74	3.10
Cement plants---------- barrels	279.0	0.6	5.7	0.02	0.95
Lime plants---------- tons	9.6	0.1	0.5	0.05	0.50
Coal Cleaning plants---------- tons	61.4	0.3	0.5	0.01	0.17
Petroleum products storage plants------ gallons[e]	5140.0	9.8	0.0	0.00	0.00
Grain mills---------- tons	43.9	3.7	7.9	0.18	0.21
Grain elevators---------- bushels[f]	1330.0	N.A.	7.5	0.01	N.A.
Varnish plants---------- gallons	52.0	0.1	0.8	0.02	0.80
Rubber plants---------- tires and tubes	170.0	2.5	2.5	0.01	0.10
Secondary nonferrous metallurgical plants--tons	2.4	1.4	11.9	4.96	0.85

a Costs for controlling particulate, sulfur oxide, hydrocarbon, and carbon monoxide emissions from facilities operating in calendar year 1967.
b Capacity is calculated assuming 1000 operating hours per year.
c Tons applies to copper, lead, zinc, and aluminum smelters; for copper & lead, capacity is input material.
d Capacity is calculated assuming 1000 operating hours per year.
e Capacity is in million gallons of gasoline storage space.
f Capacity is in million bushels of storage space.

AIR POLLUTION CONTROL OFFICER

FUNDS SPENT IN CYCLE 1

METRO-APEX -- 9/ 9/71 -- AIR POLLUTION CONTROL OFFICER --
PRINCIPLES OF AIR POLLUTION CONTROL

	FUNDS
	COUNTY
A. PUBLIC EDUCATION	$ 500.
B. ADMINISTRATION AND ENFORCEMENT	10000.
C. PLANT INSPECTIONS	3000.
D. EMISSION MEASUREMENTS	0.
E. A.Q. MONITORING STATIONS -- PURCHASE AND UPGRADE	2500.
F. A.Q. MONITORING STATIONS -- OPERATION	2500.
TOTAL FUNDS AVAILABLE THIS YEAR	$ 18500.

FEDERAL FUNDS AVAILABLE (ON A 3-FOR-1 BASIS) FOR NEXT TWO CYCL

TOTAL F

MONITORING STATION STATUS DURING CYCLE 1

AA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	1
TYPE IN EXISTENCE	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	
TYPE IN OPERATION	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	

PLANT INSPECTIONS ORDERED ON FOLLOWING INDUSTRIES --

11	12	0	0	0	0	0	0	0	0	0	0	0

EMISSION MEASUREMENTS ORDERED ON FOLLOWING INDUSTRIES --

6	0	0	0	0	0	0	0	0	0	0	0	0

A Federal funds are available only if grant is approved in current cycle. Total federal funds may not exceed three times the county appropriation.

B Total funds be sufficie information

CONTROL OFFICER --

FUNDS SPENT IN CYCLE 1

COUNTY	FEDERAL	TOTAL
$ 500.	$ 0.	$ 500.
10000.	0.	10000.
3000.	0.	3000.
0.	3000.	3000.
2500.	0.	2500.
2500.	0.	2500.
$ 18500.	+ $ 3001.	= $ 21501.

SIS) FOR NEXT TWO CYCLES = CYCLE 2 $ 0.

CYCLE 3 $ 0.

TOTAL FOR TWO YEARS $ 0.

9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0

0 0 0 0 0 0

A Total funds allocated to each category must be sufficient to cover ADCO's requests for information or activities will be curtailed.

B Figures will appear here after they have been granted.

C Analysis area. The station located in this data in the game and will be given Area number.

D Only one station. The other stations operated.

E Results of the investments will appear detailed information stations on the

F

AL

26 27 28 29

0 0 0 0
0 0 0 0

C Figures will appear here if federal funds have been granted.

D Analysis area. There may be only one monitoring station located in each Analysis Area. Most data in the game are given by Analysis Area and will be preceded by a specific Analysis Area number.

E Only one station was operated in Cycle 1. The other station in existence was not operated.

F Results of the inspections and emission measurements will appear on next page, as well as detailed information from the monitoring stations on the last two pages.

tegory must
ests for
curtailed.

AIR POLLUTION CONTROL OFFICER

PLANT INSPECTION AND EMISSION

MEASUREMENT RESULTS

METRC-APEX -- 9/ 9/71 -- AIR POLLUTION CONTROL OFFICER --
PRINCIPLES OF AIR POLLUTION CONTROL

PLANT INSPECTION AND EMISSION MEASUREMENT RESULTS

IND NO.	AA	PROCESS NAME	PROCESS OR FUEL RATE	FUEL TYPE	MAX. PRODUCTION CAPACITY	CONTROL SYSTEM			ODO
6	23	COMBUSTION	8 TONS/HOUR	LO COAL	12237 BBLS/DAY	0	0	0	0
6	23	BALL MILLS	33 TONS/HOUR		12237 BBLS/DAY	0	0	0	0
6	23	KILNS	33 TONS/HOUR		12237 BBLS/DAY	0	0	0	0
6	23	CAR LOADING	33 TONS/HOUR		12237 BBLS/DAY	0	0	0	0
11	4	BAKING COATINGS	400 TONS/HOUR		500 CARS/DAY	0	0	0	0
12	4	BAKING COATINGS	175 TONS/DAY		200 CARS/DAY	44	0	0	0

A

B

C

D

CONTROL SYSTEMS NOT IN OPERATION

44 DIRECT FLAME AFTERBURNER C

A Gamed industries may have more than one production process.

B Simulated industries are assumed to have only one production process.

D Odor is measur
with 5 repres
representing no
the number indi

DO = Dur
DT = Dur
AC = acc
SU = Sulf

POLLUTION CONTROL OFFICER --

N AND EMISSION MEASUREMENT RESULTS

	MAX. PRODUCTION CAPACITY	CONTROL SYSTEM			ODOR	EMISSION RATES (LBS/HR) SMOKE PARTS	SO2	CO	NOX	HC
OAL	12237 BBLS/DAY	0	0	0	0	R-5	1713	1550	0	286	0
	12237 BBLS/DAY	0	0	0	0	R-0	6000	0	0	0	0
	12237 BBLS/DAY	0	0	0	0	R-0	2000	0	0	0	0
	12237 BBLS/DAY	0	0	0	0	R-0	100	0	0	0	0
	500 CARS/DAY	0	0	0	0	R-0					
	200 CARS/DAY	C44	0	0	D0	R-0					

E Smoke o
number
5 inde
0 indi

D Odor is measured in stinkelmann number with 5 representing the greatest odor, 0 representing no odor. The letters preceding the number indicate the type of smell:

DD = Putrid
DT = Pungent
OC = accrid
SU = Sulfurous

A,B,C
Informa
above.

F
Total a
ordered

F NOX	F HC
286	0
0	0
0	0
0	0

E Smoke opacity is measured in Ringelmann number:
5 indicates greatest opacity,
0 indicates none

number
r, 0
ceding
ll:

A,B,C,D,E
Information gained from plant inspection alone.

F
Total amount of information gained from an ordered emission measurement.

AIR POLLUTION CONTROL OFFICER

AIR POLLUTION STATE REGULATIONS

AND INDUSTRIES

FOUND TO BE IN VIOLATION

AIR POLLUTICN STATE REGULATIONS
AND INDUSTRIES FOUND TO BE IN VICLATICN

IND NO	PRCC. NO.	DAYS IN VIOL	GROSS EMISSION REGULATIONS POUNDS/HR PART.	SO2	CO	NOX	HC	PART.
Standard — STD.			********	********	********	********	********	********
6	1	184	********	********	********	********	********	********

A B C

AIR POLLUTICN APEX COUNTY REGULATIONS
AND INDUSTRIES FOUND TO BE IN VIOLATICN

IND NO	PROC. NO.	DAYS IN VIOL	GROSS EMISSION REGULATIONS POUNDS/HR PART.	SO2	CO	NOX	HC	PART.
		STD.	400.00	50.00	3000.00	500.00	100.00	3.0000
6	1	363	1713.29	1550.12	********	********	********	105.0000
6	2	363	6000.00	********	********	********	********	88.4957
6	3	361	2000.00	********	********	********	********	29.4986

D

AIR POLLUTION RECOMMENDATIONS TO STATE
AND INDUSTRIES FOUND TO BE IN VIOLATION

IND NO	PROC. NO.	DAYS IN VIOL	GROSS EMISSION REGULATIONS POUNDS/HR PART.	SO2	CO	NOX	HC	PART.
		STD.	********	********	********	********	********	********

MAXIMUM DAILY FINE $ 250.

ATIONS			PROCESS RATE REGULATIONS POUNDS/1000 LBS					SMOKE AND ODOR
NOX	HC	PART.	SO2	CO	NOX	HC		
******	********	********	********	********	********	********	R-2	S-*
******	********	********	********	********	********	********	R-5	S-*

MAXIMUM DAILY FINE $ 80.

ATIONS			PROCESS RATE REGULATIONS POUNDS/1000 LBS					SMOKE AND ODOR
NOX	HC	PART.	SO2	CO	NOX	HC		
500.00	100.00	3.0000	0.1500	0.0100	5.0000	0.1000	R-*	S-*
******	********	105.0000	95.0000	********	17.5000	********	R-*	S-*
******	********	88.4957	********	********	********	********	R-*	S-*
******	********	29.4986	********	********	********	********	R-*	S-*

ATIONS			PROCESS RATE REGULATIONS POUNDS/1000 LBS					SMOKE AND ODOR
NOX	HC	PART.	SO2	CO	NOX	HC		
*****	********	********	********	********	********	********	R-*	S-*

B Stars on no regu requires violation

C Emission either f laur ar 1,000 lb

D Numbers regulat

```
INE      $ 250.

         I SMOKE
         I  AND
  HC     I ODOR
         I
****** I R-2 S-*
-------+--------
         I
****** I R-5 S-*
```

B *Stars on these lines indicate there are no regulations. the number to be printed requires more the eight (8) spaces, or no violation of standard was detected.*

```
INE      $  80.

         I SMOKE
         I  AND
  HC     I ODOR
         I
0.1000 I R-* S-*
-------+--------
         I
***** I R-* S-*
***** I R-* S-*
***** I R-* S-*
```

C *Emission regulations may be stated as either pounds of pollutant emitted per hour or as pounds of pollutant per 1,000 lbs. of material processed, or both*

D *Numbers give emission rates where regulations are being violated.*

```
         I SMOKE
         I  AND
  HC     I ODOR
         I
***** I R-* S-*
------+--------
```

AIR POLLUTION CONTROL OFFICER

COMPLAINTS LOG

(Tabulation of all complaints

sent or routed to APCO)

METRO-APEX -- 9/ 9/71 -- AIR POLLUTION CONTROL OFFICER --
PRINCIPLES OF AIR POLLUTION CONTROL

COMPLAINTS LOG

(TABULATION OF ALL COMPLAINTS SENT OR ROUTED TO APCO)

	TYPE OF COMPLAINT						
	PUTRID ODOR	ACRID ODOR	SULFUROUS ODOR	PUNGENT ODOR	SMOKE	II II	TOTAL BY A.
A.A. 1	0	0	244	0	362	II	606
A.A. 2	2873	0	667	0	928	II	4468
A.A. 3	0	0	0	0	0	II	0
A.A. 4	0	0	0	1710	0	II	1710
A.A. 5	387	0	1169	0	782	II	2338
A.A. 6	0	0	0	0	0	II	0
A.A. 7	0	0	0	0	0	II	0
A.A. 8	0	0	0	1310	1800	II	3110
A.A. 9	0	0	0	0	0	II	0
A.A. 10	0	0	0	2482	664	II	3146
A.A. 11	0	0	0	168	0	II	168
A.A. 12	0	414	122	0	78	II	614
A.A. 13	0	0	0	0	0	II	0
A.A. 14	0	0	0	0	0	II	0
A.A. 15	0	0	31	113	90	II	234
A.A. 16	0	0	0	0	0	II	0
A.A. 17	0	0	0	0	0	II	0
A.A. 18	0	0	0	0	0	II	0
A.A. 19	0	0	0	0	0	II	0
A.A. 20	0	0	0	0	0	II	0
A.A. 21	0	0	0	0	0	II	0
A.A. 22	0	0	0	0	0	II	0
A.A. 23	0	0	0	0	42	II	42
A.A. 24	0	0	0	0	0	II	0
A.A. 25	0	0	0	0	0	II	0
A.A. 26	0	0	12	0	6	II	18
A.A. 27	0	63	0	0	0	II	63
A.A. 28	0	0	0	0	0	II	0
A.A. 29	0	0	0	0	0	II	0
	3260	477	2245	5783	4752		16517

POLLUTION CONTROL OFFICER --

COMPLAINTS LOG

COMPLAINTS SENT OR ROUTED TO APCD

PUNGENT ODOR	SMOKE	II	TOTAL BY A.A.
0	362	II	606
0	928	II	4468
0	0	II	0
1710	0	II	1710
0	782	II	2338
0	0	II	0
0	0	II	0
1310	1800	II	3110
0	0	II	0
2482	664	II	3146
168	0	II	168
0	78	II	614
0	0	II	0
0	0	II	0
113	90	II	234
0	0	II	0
0	0	II	0
0	0	II	0
0	0	II	0
0	0	II	0
0	0	II	0
0	0	II	0
0	42	II	42
0	0	II	0
0	0	II	0
0	6	II	18
0	0	II	63
0	0	II	0
0	0	II	0
5783	4752		16517

AIR POLLUTION CONTROL OFFICER

AIR QUALITY INFORMATION

METRO-APEX -- 9/ 9/71 -- AIR POLLUTION CONTROL OFFICER --
PRINCIPLES OF AIR POLLUTION CONTROL

AIR QUALITY INFORMATION

WINTER

A.A.	PARTICULATES (MICROGMS/CU. METER)			SULFUR DIOXIDE (PPM)			CARBON MONOXIDE (PPM)			OX
	MEAN	MAX.DAY	DAYS OVER 100.00	MEAN	MAX.DAY	DAYS OVER 0.0	MEAN	MAX.DAY	DAYS OVER 0.0	ME
7	16	78	0							

SPRING

A.A.	PARTICULATES (MICROGMS/CU. METER)			SULFUR DIOXIDE (PPM)			CARBON MONOXIDE (PPM)			OX
	MEAN	MAX.DAY	DAYS OVER 100.00	MEAN	MAX.DAY	DAYS OVER 0.0	MEAN	MAX.DAY	DAYS OVER 0.0	ME
7	8	40	0							

A Micrograms per cubic meter

B PPM means parts per million

C Type 1 - monitoring station gives information on particulates.

D Type 2 - monitori... on particulates an...

E Type 3 - monitorin... on particulates, (CO).

CONTROL OFFICER --

CYCLE 1, PAGE 11
TEAM 1

INFORMATION

CARBON MONOXIDE (PPM)			OXIDES OF NITROGEN (PPM)			HYDROCARBONS (PPM)		
MEAN	MAX.DAY	DAYS OVER 0.0	MEAN	MAX.DAY	DAYS OVER 0.0	MEAN	MAX.DAY	DAYS OVER 0.0

CARBON MONOXIDE (PPM)			OXIDES OF NITROGEN (PPM)			HYDROCARBONS (PPM)		
MEAN	MAX.DAY	DAYS OVER 0.0	MEAN	MAX.DAY	DAYS OVER 0.0	MEAN	MAX.DAY	DAYS OVER 0.0

E F G

ype 2 - monitoring station gives information
n particulates and sulfur dioxide (SO_2).

ype 3 - monitoring station gives information
n particulates, SO_2, and carbon monoxide
(CO).

F Type 4 - monito
on particulates,

G Type 5 - monito
on particulate
and hydrocarb

The Air Quality
ADCO only for
establishes and
The kind of inf
type of monito

NS

DAYS
OVER
0.0

F Type 4- monitoring station gives information on particulates, SO_2, CO, and nitrogen oxides

DAYS
OVER
0.0

G Type 5- monitoring station gives information on particulates, SO_2, CO, nitrogen oxides, and hydrocarbons.

G

The Air Quality information is available to the ADCO only for Analysis Areas where he establishes and operates monitoring stations. The kind of information depends upon the type of monitoring station operated.

AIR POLLUTION CONTROL OFFICER

AIR QUALITY INFORMATION

METRC-APEX -- 9/ 9/71 -- AIR POLLUTION CONTROL OFFICER
PRINCIPLES OF AIR POLLUTION CONTROL

AIR QUALITY INFORMATION

SUMMER

A.A.	PARTICULATES (MICROGMS/CU. METER			SULFUR DIOXIDE (PPM)			CARBON MONOXIDE (PPM)		
	MEAN	MAX.DAY	DAYS OVER 100.00	MEAN	MAX.DAY	DAYS OVER 0.0	MEAN	MAX.DAY	DAYS OVER 0.0
7	9	42	0						

AUTUMN

A.A.	PARTICULATES (MICROGMS/CU. METER			SULFUR DIOXIDE (PPM)			CARBON MONOXIDE (PPM)		
	MEAN	MAX.DAY	DAYS OVER 100.00	MEAN	MAX.DAY	DAYS OVER 0.0	MEAN	MAX.DAY	DAYS OVER 0.0
7	14	69	0						

AIR QUALITY INFORMATION

OXIDE)	CARBON MONOXIDE (PPM)			OXIDES OF NITROGEN (PPM)			HYDROCARBONS (PPM)		
AY DAYS OVER 0.0	MEAN	MAX.DAY	DAYS OVER 0.0	MEAN	MAX.DAY	DAYS OVER 0.0	MEAN	MAX.DAY	DAYS OVER 0.0

OXIDE)	CARBON MONOXIDE (PPM)			OXIDES OF NITROGEN (PPM)			HYDROCARBONS (PPM)		
AY DAYS OVER 0.0	MEAN	MAX.DAY	DAYS OVER 0.0	MEAN	MAX.DAY	DAYS OVER 0.0	MEAN	MAX.DAY	DAYS OVER 0.0

● 29 APEX ANALYSIS AREAS

TOWNSHIP 1

Areas 23, 24, 25, 26, 27 and 28

TOWNSHIP 2

Areas 14, 15, 16, 20, 21, 22 and 29

SUBURB

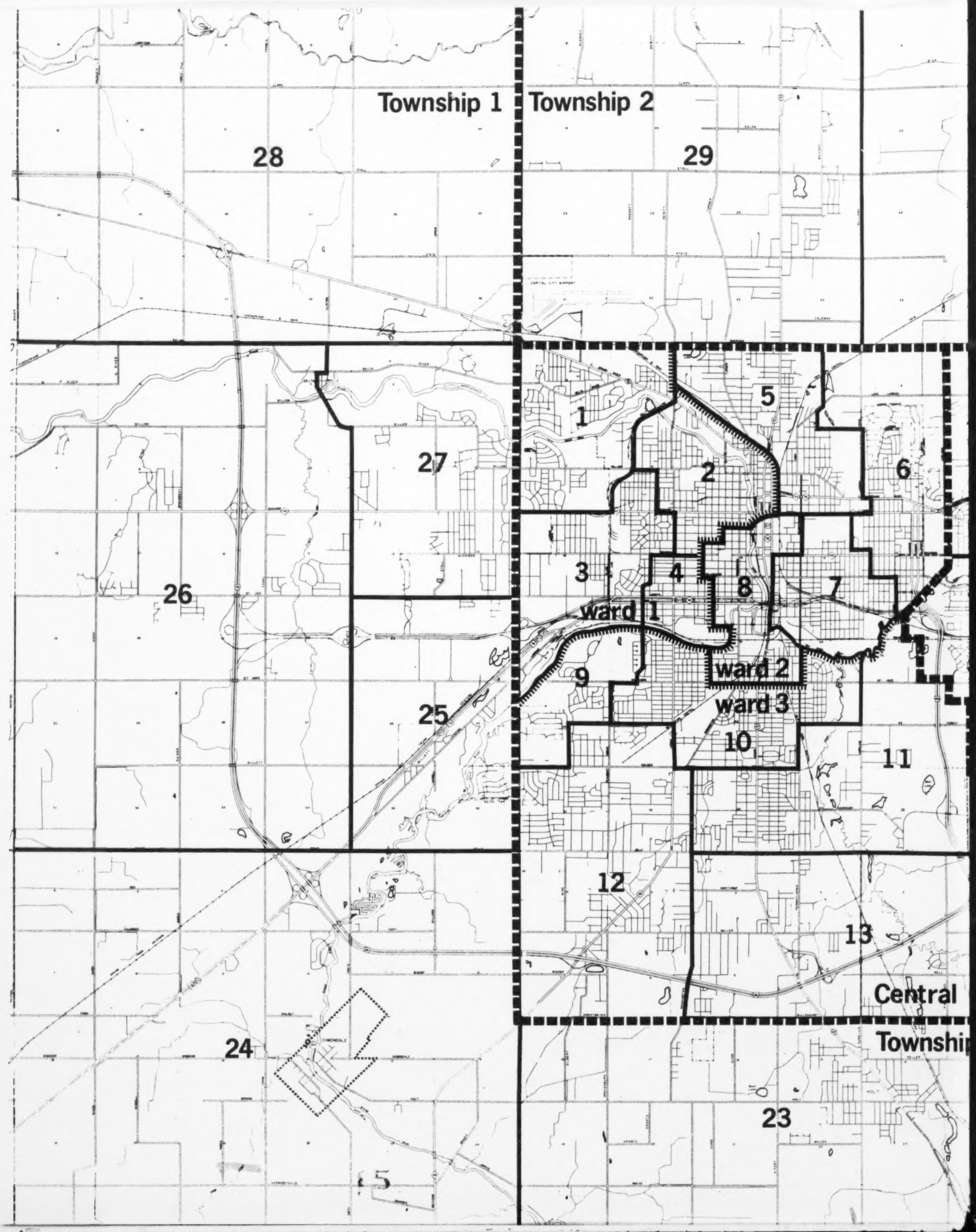
Areas 17, 18 and 19

CENTRAL CITY

Ward One: Areas 1, 2, 3, and 4

Ward Two: Areas 5, 6, 7 and 8

Ward Three: Areas 9, 10, 11, 12 and 13


Township 1
Township 2
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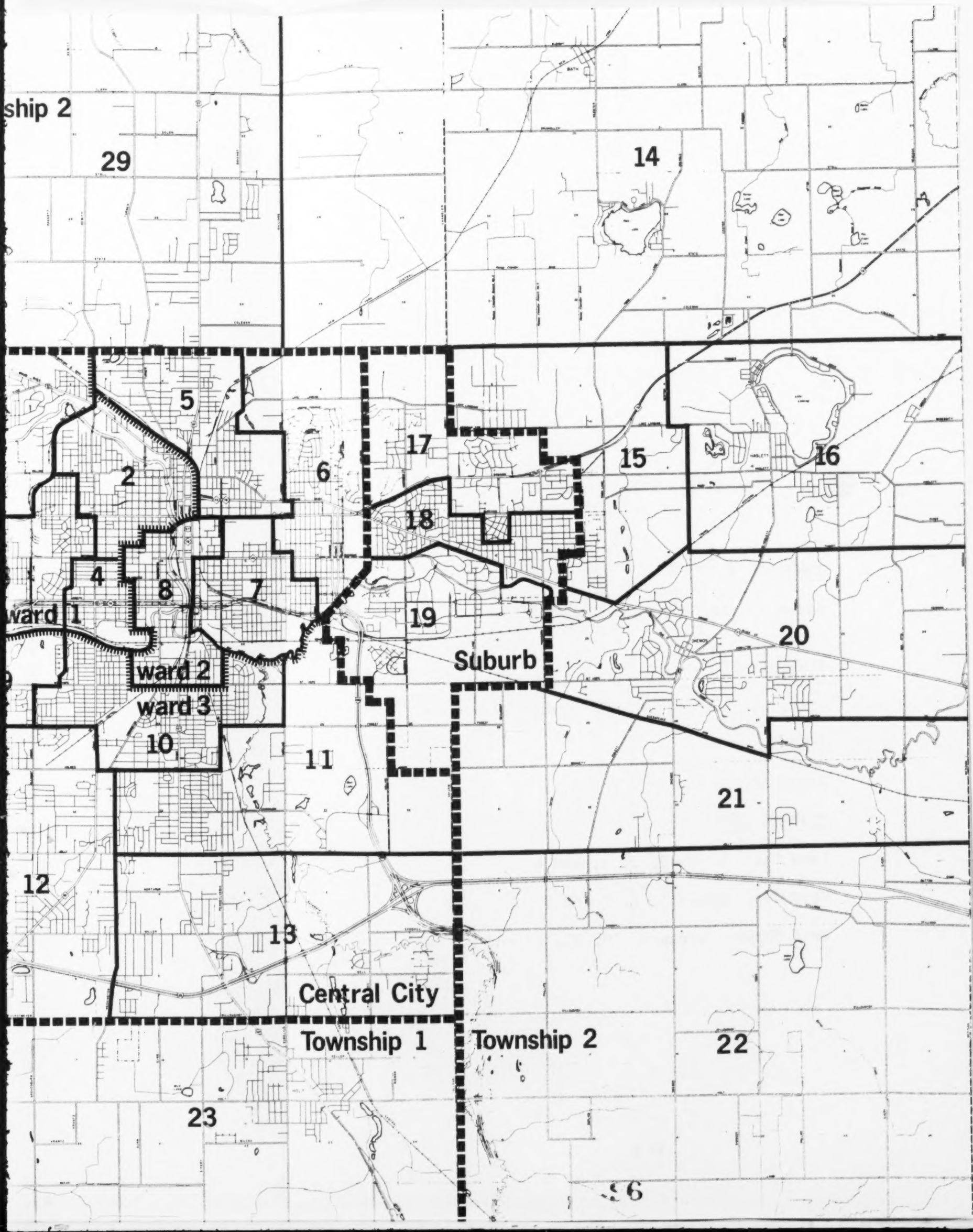
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Central City
Township 1
Township 2
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UNITED STATES · ENVIRONMENTAL PROTECTION AGENCY ·